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INDICATIONS AS TO CLIMATIC CHANGES FROM THE TIMBERLINE OF MOUNT WASHINGTON[1]

By Dr. ROBERT F. GRIGGS

NATIONAL RESEARCH COUNCIL

WE stand on historic ground. The arctic plants of the Alpine Garden, here isolated on Mount Washington, played a decisive role in establishing Plant Geography as a science; and this science was the crucial point on which turned the acceptance of the doctrine of Evolution. In the years before 1859 progressive naturalists were seeking an answer to the riddle of the Origin of Species. No aspect of this problem was so vexing in those days as the question raised by species with disjunct distribution. Had there been two acts of creation resulting in identical species, one in each of the separate ranges? or was the present dispersal the result of immigration from a single original center? It was the answer to this question which finally disposed of the doctrine of special creation in the minds of Darwin and his associates. Feeling the need of additional data on this question, Darwin asked his friend, Asa Gray, to discuss the relationships of our eastern flora. Gray did so under the unpretentious title of "Statistics of the Flora of the Northern States."[2] In a second paper, still antedating the "Origin" he amplified and strengthened the theoretical opinions cautiously expressed in the first.[3]

[1] Address given at the Symposium on Alpine Ecology, Ecological Society of America, Mount Washington, June 26, 1941.

[2] *Am. Jour. Sci.*, Ser. 2, 22: 23, 1856–57.

[3] "On the Botany of Japan." Mem. Am. Acad. Arts and Sciences, 6: 443 *et seq.* (Read December 14, 1858,

You will wonder how the isolated occurrence of a few arctic species here could have any great significance. We in this generation, indeed, expect as a matter of course to find arctic species in alpine habitats. It is hard for us to see the point of view of the naturalists of 85 years ago. The theoretical spectacles through which pre-Darwinian scientists had to look at the world, however, made it more difficult to understand small outlying stations far from the main body of the range of common species than the occurrence of distinct endemic species limited to single stations.

The scientists of those days were struggling with the belief not only that species were created as they now are but where they now are, *i.e.*, confined to their present habitats and in substantially the same numbers as they are to-day. Listen to Gray[3] on the difficulty of this question:

> The fundamental and most difficult question remaining in Natural History is here presented:—The question whether this actual geographical association of congeneric and other nearly related species is primordial and, therefore, beyond all scientific explanation, or whether this may be *to a certain extent* (ital. mine) a natural result. The only noteworthy attempt at a scientific solution of the problems, aiming to bring the variety as well as the geographical association of existing species more within the domain of cause and effect, is that of Mr. Darwin and (later) of Mr. Wallace—partially sketched in their short papers, "On the tendency of Species to form varieties and on the perpetuation of Varieties and Species by means of Selection, in the *Journal of the Linnaean Society*, Vol. 3 (Zoology), page 45." . . .
>
> Professor Agassiz maintains, substantially, that each species originated where it now occurs, probably in as great a number of individuals occupying as large an area, and generally the same area, or the same discontinuous areas as at the present time.

But, as Gray pictured the situation:

> . . . At length—the glacier epoch came slowly on—The change was so gradual that it did not destroy the temperate flora, which . . . must have been pushed on the lower latitudes as the cold advanced; and between them and the ice there was doubtless a band of subarctic and arctic vegetation—portions of which retreating up the mountains as the climate ameliorated and the ice receded, still scantily survive upon our highest Alleghanies and, more abundantly upon the colder summits of the mountains of New York and New England:—demonstrating the existence of the present arctic-alpine vegetation during the glacial era.

That is to say, before Gray's challenge, men felt that they had to believe that the many arctic species which are found in the alpine zone of the Presidential Range required an especial visit of the Creator to produce them, there! Outlying colonies of plants and animals far from the main body of their ranges are among the common phenomena of nature. No two outlying stations preserve exactly the same set of relicts. So it is easier to understand how confusing, not to say irrational, the acts of the Creator appeared to would-be interpreters of nature before Gray boldly declared:[3]

> I cannot resist the conclusion that the extant vegetable kingdom has a long and eventful history, and that the explanation of apparent anomalies in geographical distribution of species may be found in the various and prolonged climatic or other physical vicissitudes to which they have been subject in earlier times.

I need hardly add that, though we are now convinced that an adequate knowledge of the history of such cases would bring complete understanding of them, we are still very far from having unravelled the tangled events involved. We are assembled here to-day, largely to take stock of the progress of that quest from the angles represented by the workers in different fields here present. We know that we shall learn of notable things that others have accomplished, each in his own specialty. Perhaps, from this day's exchange of information and ideas, we can to advantage map our future efforts.

I may begin by stating, what is familiar to all of you, that the very general terms of Asa Gray's original *Glacial Relict Theory* are by no means detailed enough to satisfy the scientific curiosity of those who have later sought to interpret the plant geography of northeastern America. Relict species have, rather, continued to be a matter of discussion down to the present day. The most extensive expression of that interest is to be found in the many papers of Professor Fernald and others, elaborating and discussing the "Nunatak hypothesis."

In addition to such arctic plants as those growing around us here in the "Alpine Garden," there are isolated in northeastern America tiny outliers of many other species, the main body of whose ranges lie elsewhere, often not at all in the arctic. The "Nunatak hypothesis" supposes (1) that these species survived the last (Wisconsin) glaciation by persisting on areas which, though surrounded by the continental glacier, were not covered by ice, like the nunataks standing above the Greenland ice-sheet of to-day; and (2) that since the Wisconsin glaciation they have for the most part remained confined to their nunatak refuges. The existence of a notable collection of such plants is taken as prima facie evidence according to this view that their habitat was free from ice and otherwise favorable for plant life through Wisconsin times, *e.g.*, the Keewanaw Peninsula of upper Michigan.[4]

An essential feature of these relict theories is that

and January 11, 1859.) ("The Origin of Species" was published on November 24, 1859.)

[4] M. L. Fernald, *Rhodora*, 37: 197–228, 1935.

they envisage conditions as static. To be sure, they do recognize that the invasion of the ice sheet had caused readjustments of the flora in the dim geologic past. But they take little specific account of plant migrations since the glaciation.

Until the last decade or two there has been a great gulf fixed in men's minds between geological time and historical time. Changes in climate since the last ice age were discussed at the International Geological Congress at Stockholm in 1910, the opinion was then expressed that the deterioration of climate in Scandinavia shown by late Pleistocene deposits might likely be continuing into the present. But no means were discovered of testing this opinion by evidence.[5] Since 1910, however, notable progress has been made in connecting the geological past with the historical past.

We should look at these arctic plants here hanging on and at these trees here stretching up the mountain slopes as mute indicators of climatic trends and we should seek to unravel their story. The tension zone between subalpine forest and alpine tundra ought to be one of the most favorable of all places to discover what is going on. Specifically, are these dwarfed and crippled trees, in whose shelter you crouch as you listen, advancing up the mountains under conditions still improving since Wisconsin times or are they being beaten back by a worsening climate?

This timberline differs markedly from those of Western America. On the arctic timberline in Alaska the trees are not deformed in any way but, as studied especially at Kodiak,[6] are normal spire-shaped conifers and maintain a reproduction and rate of growth comparable with that of the same species a thousand miles inside the arctic border. Here there is conclusive evidence, botanical and historical, that the trees are advancing into the tundra. We conclude that climate is improving in Alaska.

In the Northern Rocky Mountains the uppermost trees are recumbent and their growth is reduced, but very old trees, erect and undwarfed, occur close to extreme tree line, and the trees commonly retain their full size up to or beyond the point where the forest begins to thin out and give way to open meadow so that one may usually walk with ease through the forest at timberline in any direction. Conditions here convinced me that in this area timberlines have been static for a number of centuries.[7]

In the White Mountains the forest begins to be stunted 2,000 feet below the timberline. The trees become shorter and denser with ascent until, still retaining the erect arborescent form, they form a compact level-topped elfin forest over the top of which you may sometimes walk but which you can penetrate only by chopping your way. Above this scrub, the trees, still further dwarfed, form in places extensive carpets close-clipped by wind and snow blast. These appear from a little distance like well-kept lawns. In the most extreme of these, all tendency to form upright leaders is suppressed and only lateral branches are produced.

Second, the trees on the exposed portions of the Presidential Range and to a considerable extent elsewhere in the White Mountains are confined to specially protected situations such as the lee of a bowlder. Old trees come finally exactly to fill a streamlined outline matching the flow lines of the prevailing wind around the projecting bowlder. The winds at Kodiak do not deform the trees at all, and in the western mountains such excessive wind action is rare and local. There clumps of trees may, indeed, be differentially dwarfed and wind-shorn on the windward side (see photographs[7]), but they often stand in the open without protection.

Third, seedlings or young trees of the conifers are rare near tree line in the White Mountains. But on the western mountains seedlings of fir and spruce are readily found up to and beyond the last of the established trees. Most of these, as would be expected, grow a few years and then succumb. At Kodiak seedlings are not only common, but vigorous and persistent, providing the means for the active migration into the Arctic. The absence of seedlings on the heights of the Presidential Range is not due to any scarcity of seed—every bank at favorable levels in the forest and well into the zone of dwarfing is covered with seedlings. Nor is it due to lack of wind to scatter the seed over the alpine zone—the winds on Mount Washington are second to none.

The seeds of fir and spruce which lodge in the alpine zone of the White Mountains must, with rare exceptions, be killed as they germinate.

Trees are now occupying a rather wide zone on these mountains which they could not colonize under present conditions. They hang on by virtue of the freedom with which they spread by putting out roots along their prostrate trunks. Because of this habit trees can persist indefinitely without reseeding, continuously rejuvenating the tips while dying behind. It is not at all uncommon to find a prostrate tree whose distal, younger portion is larger than the proximal, older part by reason of growth supported by adventitious roots. Thus there may be more rings in the younger portion of a trunk than in the older. The real age of such a "tree" can by no means be ascertained from the number of rings in its trunk. Some of these prostrate cripples have probably persisted for centuries.

[5] Gunnar Andersson, "Veränderungen des Klimas seit dem Maximum der Letzen Eiszeit," 11th Int. Geol. Cong. Stockholm, p. 292, 1910.

[6] R. F. Griggs, *Ecology*, 15: 80–96, 1934.

[7] *Idem*, *Ecology*, 19: 548–564, 1939.

We must ask ourselves now how the trees above the zone of seedlings ever became established. The simplest explanation and, I believe, the true one is that the upper trees on Mount Washington are hold-overs from a time of more hospitable climate when seedlings could start in places where they are now killed off.

The next question is whether the highest trees under these conditions are holding their own in spite of the lack of reinforcement, so to speak, by new seedlings. To answer, the differences in reproductive condition between this and normal forest must be brought out. In normal forests, even in many of the patches of upright trees high up on the Presidential Range, all stages occur: seedlings, saplings, mature trees, dead stubs, decaying logs; some are vigorously adding new wood year by year, others are standing nearly still, others, at the limit of their life span, slipping backward and the proportion of dead wood to live, increasing.

But among these crippled trees distinctions between youthful vigor and decrepit age appear more between the parts of a single tree than between different trees. Prostrate branches covered with snow through the winter and rooting freely maintain indefinitely the condition of youth and, barring accident, can spread for long periods. But, whenever these snow-covered mats send up vertical shoots, they begin to suffer. The upright trunks in the transition zone between forest and prostrate carpets are the best indicators which way the balance is tipping.

On most of these trees the branches of the live uprights have been slowly diminishing for a number of years. This does not mean that upright growth is stopped. Supported by the large mat of recumbent branches at the base, the leaders of a timberline tree will often make strong growth year after year—I have measured 17 inches. But on balance, winterkilling nearly always exceeds growth. For example, one tree on Osgood Ridge had a dead trunk about six feet tall. Directly to lee of this was a second leader which, though sheltered by the older trunk, had attained a height only about four fifths as great. Yet it had reached its limit and was on the point of death, only a few small twigs remaining alive. Further to lee was a shorter oblique shoot about two feet high which remained healthy.

Such a tree presents a diagrammatic picture of what appears to be happening generally: The trees seem to be in process of being forced into more and more recumbent positions.

In a few places, where the old forest was killed back half a century or more ago by some catastrophe, probably fire, there remain stumps of old trees larger than any that now grow on the sites. The new trunks that have come up since have now reached their limits and are held at sizes somewhat less than half the originals.

One of these is on the lee side of Osgood Ridge, where a narrow tongue of trees reaches up from the forest into the alpine zone. At the tip of this tongue are two picturesque repeater trunks, standing above the subprostrate snow mat. The largest of these measures 5 inches in diameter. It has made 20 successive attempts to push up a leader. Immediately in front of it stands a shell of a predecessor trunk which was 12 inches thick.[8]

These large old stumps again are difficult to interpret except as indicators that the climate on Mount Washington has grown worse for trees within the last century.

But changes in climate are regional rather than local. Before we can draw conclusions from the retreating timberline of Mount Washington, we must look further afield. Scattered through the literature is a good deal of evidence that the climate of northeastern America has changed considerably during the last thousand years. Fortunately these have been brought together by Raup,[9] first for New England and New York and later as a part of a more general review.[10] Evidence from many sources indicates a very definite worsening of climate during the latest centuries over all northeastern America from New York northward. Perhaps the best-attested and certainly the best-dated of these evidences is the gradual freezing out of the old Norse Colonists of Greenland. Accounts indicate that the new Green land, discovered by Lief Ericson in the tenth century, offered considerable advantages over Iceland as a home for European colonists. The Norse colony in Greenland, supported by dairy farming and exports of cheese to the mother country, had a prosperous existence until the latter part of the twelfth century. The Norsemen hung on in Greenland until the fifteenth century, but increasing rigor of climate caused a pitiful decline and final extinction. The recent excavation of this colony has brought to light physical facts which abundantly corroborate the old records of increasing ice in the sea and similar difficulties. Perhaps the most significant of these physical evidences is the fact that the colonists lie buried in soil which is now perpetually frozen. Yet their coffins and even the marrow of their bones are permeated by tree roots. Since tree roots can not penetrate frozen soil, these must have grown before the ground froze up, *i.e.*, in a period with a milder climate than the present.[11]

[8] These and other features of timberline on Mount Washington will be described in detail in another place.

[9] Hugh M. Raup, *Jour. Arnold Arboretum*, 18: 79–117, 1937.

[10] *Bot. Rev.*, 7: 209–248, 1941.

Fitting in with these human records is the fact, commented on by many botanists, that plants of Greenland seldom ripen seed under present climatic conditions, though the same species are fully fertile in more hospitable climates.

Several observers[10] report that the arctic timberline in northeastern America is retreating, *viz.*, "West of Hudson's Bay," by Sir John Richardson and Johannsen,[10] "East of Hudson's Bay," by Abbe.

The situation on the north shore of the Gulf of St. Lawrence is discussed by Marie Victorin.[12] The record of Jacques Cartier indicates a wider extension of forest near the Straits of Belle Isle in 1534 than at present, but the geographical reference is rather vague. However, Fernald[13] has recorded stumps a foot in diameter at Blanc-Sablon, where to-day is only moss and bog. Likewise there are a number of puzzling relicts of southern plants in this region which point to a former period of warmer climate. These facts caused Marie Victorin to remark, "One could perhaps go further and ask himself if the present spruce forest of the north coast, of Anticosti and elsewhere is not irretrievably doomed, maintaining itself only by virtue of the mutual protection the trees give each other and whether if once destroyed over a large area this forest would be able to reconstitute itself."

It has been suggested, not infrequently, by those considering the evidence of deteriorating climate that another glacial period may be coming on. The evidence in our possession does not justify so strong a statement. All that is proved is that climate in our part of the earth is undergoing a prolonged deterioration in terms of human history. We do not yet know enough of climatic change to distinguish variations of merely historical importance from those of geological consequence.

The geological implications of the worsening of climate being experienced in northeastern America lie rather in another direction—in their bearing on the problem of the correlation of ice ages. Were the Pleistocene glaciations of the northern hemisphere simultaneous throughout, or did the centers of the ice-sheets shift about so that first one area was glaciated, then another? It is the current belief of geologists that the Wisconsin glaciation of America and the Würm of Europe were synchronous. But it should be remembered that, despite the remarkable work that has been done in following the retreat of the ice year by year through study of the varves, there are in America breaks in the varved record which prevent the assignment of definite dates. The character of the gaps in the sequence and the irregularities in the rate of melting of the ice over the area where the sequence is complete preclude any estimate of the time periods covered by the breaks in the record and so of any definite correlation with events in Europe. Kirk Bryan[14] has recently remarked in this matter:

> Unfortunately, there is no absolute proof that glaciation was synchronous over the earth. The synchroneity is at best a doctrine supported by: . . . These arguments when set down seem weak indeed. On the other hand, there is no valid argument to the contrary. . . .

On the principle that the simplest hypothesis possible should be invoked to explain any phenomenon, a theory of alternative continental glaciation is preferable to one of total hemispheric refrigeration. The latter requires some drastic change in the amount of radiation supplied to the earth. But local glaciations covering merely parts of continents such as that of Greenland to-day require merely shifts in the positions of present climatic provinces.

It is indeed a matter of primary importance for the interpretation of glaciation to remember that the Pleistocene ice sheets were always largely restricted to western Europe and northeastern America. In neither northwestern America nor northern Asia was glaciation so well developed as in the lands on both sides of the Atlantic.

As a matter of fact the Wisconsin glaciers throughout their various stages were always of limited and regional rather than of truly continental extent. The Islands of the Arctic Archipelago lying north of the ice sheets were never glaciated. Neither was the interior of Alaska.

The center of Wisconsin glaciation moreover moved from Labrador to Keewatin during the epoch. What sort of climatic changes could produce these shifts in the center of ice accumulation? Who can imagine a shift in present climate that would produce a continental glacier on the Arctic Archipelago while allowing that of Greenland to dwindle away? Yet something very like that happened in Wisconsin Time when the glacial center moved westward across Hudson's Bay from Labrador to Keewatin.

The evidence of the timberlines shows, however, that climatic changes of that type are occurring to-day. The climate in Alaska has recently become more favorable for trees and that of the northeastern portion of the continent less favorable. Everything indicates these changes are still going forward. When we come to understand their causes, it may be that we shall be set forward also in an understanding of the causes of ice ages.

[11] Poul Norlund, "Viking Settlers in Greenland and their Descendents during 500 Years." Cambridge University Press, 1936.

[12] Frére Marie Victorin, Cont. Bot. Lab. University of Montreal, No. 131, p. 77 *seq.*, 1929.

[13] M. L. Fernald, *Rhodora*, 13: 109–62, 1911.

[14] SCIENCE, 93: 509, 1941.

"VEGETABLE DYNAMICKS" AND PLANT TISSUE CULTURES[1]

By Dr. PHILIP R. WHITE
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SOME time ago, at a dinner at the Yale Medical School, I was asked to occupy the chair specially built for the Honorable William Howard Taft when he was professor of jurisprudence at Yale—and was made to feel very, very small thereby. Now you have done me the honor to link my name, however tenuously, with that of the father of our discipline, Stephen Hales. It is hard to know whether to be inflated by the connection or deflated by the comparison. Whatever should be my reaction, I deeply appreciate the honor. In accepting that honor, I shall try not to impose upon your patience after a good meal by talking to you too long.

Stephen Hales's interests, as a minister of the gospel and a humanitarian, led him to touch upon anything which could contribute to the welfare of his fellow men and redound to the glory of Almighty God. The processes by which God's creatures function in their everyday lives could, according to his lights, only show the perfection of the works of the Great Planner. Thus, Hales set to work to discover what details he could in that plan, in a spirit of humility. And, since plants were also God's creatures and Hales was a good gardener as well as a good shepherd, he turned much of his interest to a study of what he chose to call "Vegetable Staticks."

In Hales's day, the classification of plant parts into tissues, proposed by the Greeks, and especially by Theophrastus, had been for the most part forgotten, and his considerations were wherever possible of the plant as a whole. But the philosophical analyses of Theophrastus and the anatomical work of Grew and Malpighi, Hooke and Loewenhoeck had already laid the foundations for another point of view. As our knowledge of the living functions increased, so did the complexity of the plan revealed increase, until it became an almost hopeless task to unravel the details while trying to encompass the whole picture, even as regards a single creature. Thus it happened that, about a century after Hales's epoch-making work, there came to be formulated the so-called cell theory which said, in essence, "It is not necessary to encompass the plan of a plant or animal in its entirety and all at once, for each creature is made up of a sum of many smaller, simpler, potentially autonomous organisms, the cells. Learn to understand the plan of a single cell. From that the greater Plan can be built up." That theory, while sharing the field with the older concept of the organism as a whole, has nevertheless dominated much of our thoughts as cytologists, as anatomists, as geneticists and as physiologists for the past century.

Hales developed a series of techniques for studying the organism as a whole which are still useful. But, as we have passed from the larger aspects to smaller and still smaller ones, the technical difficulties have increased. To deal with single cells, we must have methods adapted to that end. Haberlandt saw that clearly forty years ago and set in train the series of explorations of which I am but one of the momentary advance guard.

We can not yet grow single somatic cells of higher plants, as Haberlandt would have had us do. Some day I am certain some one will be able to do so. But we can grow comparatively simple organs and tissue complexes. A few of you, I know, have followed the steps by which that has been accomplished. Others I am sure have not, and I hope I will be forgiven if I review briefly for their benefit the development of the field. The aim was, as we have said, the study of single somatic cells of higher plants. The method aimed at was the cultivation of those cells, their study as separate entities, and their subsequent aggregation into more and more complex groupings until full-blown organisms could again be attained. Haberlandt tried to grow single green somatic cells, unsuccessfully, as did many of his students. Kotte and Robbins in 1922 compromised by using, not cells, but organs—root tips—with some success. But the results were not sufficiently promising to encourage further work and the attempt was not pushed further. A decade later the problem came to my attention and I decided, on theoretical grounds, to study three types of materials—embryos, seed primordia and root tips. Of these, the last proved most satisfactory. With them a beginning has been made toward a solution of the problems involved.

Fundamental, of course, was the need of an environment that should replace all the essential features of that in which the cell or tissue or organ finds itself in the organism while discarding the non-essentials—as regards physical and chemical composition of that environment. Temperature, light, oxygen tension, acidity, physical state, motion, conditions of contact, as well as ionic composition, content in energy sources, hormonal and vitamin content and similar aspects all

[1] Abridged from the Stephen Hales Prize Address, given before the American Society of Plant Physiologists, Dallas, Texas, December 29, 1941.

had to be studied. And, while many of these requirements were likely to prove similar for all cells, others might not prove similar. We have solved all these problems in a preliminary way. But those solutions are in many cases obviously not yet the most perfect ones possible, and the work still goes on. We are on fairly firm ground as regards the physical conditions, the inorganic nutrition and the carbohydrate supply. Requirements as regards organic nitrogen supply, vitamins and hormones are less clearly established, although conditions which are "satisfactory" are known.

We are, however, now in a position to grow a variety of plant materials, root tips of many species, embryos, undifferentiated tissue masses from *Salix, Nicotiana, Helianthus, Daucus, Ulmus,* and a few other sorts, *in vitro,* for long periods and to control the environments in which they grow with a considerable degree of precision. The technique for which Haberlandt was searching is thus now available and it is, I trust, because of the part I have played in developing that technique, rather than for any particular application, that you have honored me this evening.

It would be superfluous for me to review our findings in detail here. It is my task, rather, to point out the directions in which we have already moved and perhaps to outline briefly some of the new fields in which we may hope to find opportunities for further work.

As I have already noted, problems in nutrition were among the first to present themselves and the way in which they have been solved points to other possibilities in the same direction. How significant is the calcium-magnesium balance in the economy of an isolated tissue? Less so, I think, than we have long been led to believe. What is the value of iron for cells which possess no chlorophyll? Our results show an unusually clean-cut picture of its importance. Iron is not tolerated at an ionic concentration above about 2×10^{-5} (= 2/100,000) M; yet its omission from the nutrient results in an abrupt and complete, but reversible, cessation of growth. That its function is an indispensable one is evident. What that function is we do not yet know, but the tissue culture technique offers us a hope of finding out. How far is the effectiveness of sucrose in the nutrient to be attributed to the energy it supplies, and how far to its function in maintaining an isotonic state? Our studies emphasize its energy-giving function and show that the isosmotic function is relatively unimportant. How does iodine affect the morphogenetic pattern? How does oxygen tension affect this same pattern? And how does sucrose, a classic plasmolytic agent, penetrate to the interior of the cell? When I published experiments showing that excised tomato roots preferred sucrose to dextrose, I let myself in for some criticism from those who followed the text-book story. But I also received a very heartening and interesting letter from Dr. Annie May Hurd-Karrer, saying that in 1926 she had been puzzled by evidence of a similar preference by *Ustilago* infecting corn. Perhaps the question needs to be re-examined. The text-books have sometimes been wrong. How important is auxin in the economy of an excised member? What is the function of thiamin in a growing tissue? What is the relation between pyridoxine and protein synthesis in the plant? These are but a few characteristic nutritional problems that have been or can be attacked by means of a tissue culture technique.

But the value of the method is by no means limited to nutritional problems. We were from the start interested in using it in dealing with a variety of problems in plant pathology. Some of these have led us into unexpected paths. The method by which viruses travel through the host has long been a puzzle to phytopathologists. This is paralleled and perhaps intimately bound up with the methods by which foods move in the plant. And it is also conceivably bound up with the methods by which water may sometimes be moved through the plant when certain external forces are temporarily in abeyance. The picture of water movement as a function of vital activity of plant tissues has long been a puzzling one. Five years ago, I set out to study this picture as exemplified in growing excised roots, where the complicating factors of photosynthesis, evaporation, trunk expansion and contraction under temperature influences, local hydrolysis, etc., could be eliminated. We have not solved the problem as far as demonstrating a detailed mechanism is concerned. But we have been able to establish certain significant facts in an unexpected and striking way, facts which tend to support and enlarge upon Stephen Hales's old concept of water secretion as a vital function of root tissues, bound up with respiratory processes. Those results at the time seemed again to run counter to accepted text-book theories. But they have since found support in work of Rosene, Grossenbacher, Mason and Phyllis, and others. And the picture which Mason and Phyllis draw certainly corresponds rather closely to that of the contractile vacuole in protozoa, which is another little-understood phenomenon.

Recently we have come back to one of the first problems for the solution of which the value of a tissue culture technique was foreseen, that of the etiology of neoplasia. This we have attacked in plants, using tissues affected at a previous time by crown-gall organ-

isms. The method permits us to maintain growing tumor tissues under continuous and detailed observation, to establish by appropriate tests their freedom from contamination, to subject them to controlled environments, and then, at suitable intervals, to return them to appropriate hosts, where they give rise to new tumors. We have already followed by similar means the processes of growth and differentiation in a neoplasm of genetic origin—that arising in the hybrid cross between *Nicotiana glutinosa* and *N. langsdorffii*. The step from there to neoplasia of biologic (parasitic) origin has not proved a difficult one. May we not hope later to proceed a step further, to neoplasia of recognizable and controllable physiological origin?

These are but a few examples to indicate the proven as well as potential scope of the field which the technique of tissue cultures opens to us. Stephen Hales was not thinking in terms of this sort. But these problems are such that their solution, by whatever means, can give us greater insight into the workings of biological entities, cells, tissues, organs, and thereby of the organisms which were Hales's interest. They may well help us to understand some new bits of the universal plan which he sought to elucidate.

OBITUARY

JAMES J. WALSH

DR. JAMES J. WALSH, of New York, died on March 1. Son of Martin J. and Bridget Golden Walsh, he was born at Archbald, Pennsylvania, on April 12, 1865, so that he was in his seventy-seventh year. He obtained the degree of bachelor of arts from Fordham College in 1884, and that of master of arts in 1885, and then entered the Society of Jesus, intending to pursue a career in the Church, but a few years later was released of his vows, when he felt that he was not fitted for the priesthood. The training with the Jesuits made a lasting impression upon him and gave him skill in dialectics. In 1889, Walsh received the degree of doctor of philosophy from Fordham College.

He began the study of medicine at the University of Pennsylvania and required only two years to complete his course, graduating M.D. there in 1895, with his younger brother, Joseph, whose studies of Galen have delighted the readers of the *Annals of Medical History*. During the next three years he studied in Paris, Vienna and Berlin, where he and his brother had a place in Virchow's laboratory. Whilst in Europe, Dr. Walsh began his career as a medical writer, acting as correspondent for several American journals, and when he returned in 1898, he became assistant editor of the *Medical News*. Later he wrote much for the *New York Medical Journal* and the *Journal of the American Medical Association;* he was the medical and scientific editor of the *Independent* and the medical editor of the New York *Herald*.

In 1900 he was appointed an instructor in medicine and an adjunct professor in 1904 at the New York Polyclinic Medical School, where he taught until 1907, when he was made acting dean and professor of neurology at the Medical School of Fordham University. Here he remained until he resigned in 1913. At Fordham he gave regular lectures on the history of medicine, which were amongst the early ones to be established in the United States. He also lectured on physiological psychology, of which subject he was professor at Cathedral College, New York (1907–1938).

Dr. Walsh was the author of many books, and he established the Fordham University Press. Some of his more important works were "Catholic Churchmen in Science," Philadelphia, 1906; "Makers of Modern Medicine," New York, 1907, which was dedicated to his friend, William Osler; "The Thirteenth, the Greatest of Centuries," New York, 1907; "The Popes and Science," New York, 1908; "History of Medicine in New York," 5 volumes, 1919. Dr. Walsh was always a loyal son of the Roman Catholic Church. His paper, "The Popes and the History of Anatomy," appeared in the *Medical Library and Historical Journal*, Vol. 2, 1904, and that on "The Supposed Warfare between Medical Science and Theology," in the *Messenger*, New York, July, 1906. Dr. Walsh was an authority upon the history of the Roman Catholic Church. He was made a Knight Commander of the Papal Order of St. Gregory and also a Knight of Malta and received many honorary degrees. He belonged to numerous societies, was a life member of the New York Historical Society, a fellow of the New York Academy of Medicine and a member of the American Medical Association.

In 1915 Dr. Walsh married Miss Julia Huelat, who, with a son and daughter, survives him.

ARCHIBALD MALLOCH
NEW YORK ACADEMY OF MEDICINE

RECENT DEATHS

DR. RAYMOND LEE DITMARS, curator of reptiles and of mammals of the New York Zoological Park, died on May 12 in his sixty-sixth year.

BRONISLAW K. MALINOWSKI, Bishop Museum visiting professor at Yale University, who had been appointed professor of cultural anthropology at the university, effective on July 1, died on May 16. He was fifty-eight years old.

DR. CLAYTON HALSEY SHARP, from 1914 to 1933 vice-president of the Electrical Testing Laboratories, New York, died on May 15, at the age of seventy-two years.

DR. RUDOLF EMIL HELLMUND, chief engineer of the Westinghouse Electric and Manufacturing Company, with which he had been associated since 1907, died on May 16, at the age of sixty-three years.

DR. GEORGE SELLERS GRAHAM, associate in pathology of the Graduate School of Medicine of the University of Alabama, died on May 2, at the age of sixty-three years.

DR. H. L. BOWMAN, from 1909 to 1941 Waynflete professor of mineralogy and crystallography at the University of Oxford, died on April 22, at the age of sixty-eight years.

DR. WILLIAM JOHN YOUNG, professor of biochemistry at the University of Melbourne, known for his work on alcoholic fermentation, died on May 14. He was sixty-three years old.

LIEUTENANT-COMMANDER L. C. BERNACCHI, physicist to the Southern Cross Antarctic Expedition, 1898, and to the National Antarctic Expedition, led by Captain Scott, R.N., 1901–04, died on April 24, at the age of sixty-six years.

SCIENTIFIC EVENTS

THE GEORGE F. BAKER PAVILION OF THE NEW YORK HOSPITAL

THE private patients' division of the New York Hospital will be named the George F. Baker Pavilion, commemorating the part played by Mr. Baker and his son, George F. Baker, Jr., in the development of the institution.

The pavilion, having six floors and more than 100 rooms for patients, comprises, with the medical and surgical floors, the central unit of the New York Hospital-Cornell University Medical College center, 68th Street and York Avenue. Formerly known only as a part of the general hospital, the George F. Baker Pavilion now becomes one of the six separate services conducted by the Society of the New York Hospital, which include the New York Hospital, the Lying-In Hospital, the Children's Clinic, the Payne Whitney Psychiatric Clinic and the New York Hospital-Westchester Division.

In connection with this pavilion, the Board of Governors also voted to open the entrance for private patients, and to place an inscription thereon to read "The George F. Baker Pavilion." The dedication of the pavilion will take place on September 1, the tenth anniversary of the opening of the present hospital buildings.

Mr. Baker senior was a governor of the hospital from 1899 to 1931, and his son from 1931 until his death in 1937. Their combined service thus covered a period of approximately forty years, which was probably the most eventful and progressive in the one hundred seventy-year history of the New York Hospital. The advances made during this period, culminating in the opening of the present center in 1932, were due in large part to the vision and leadership of the father and son, as well as to their generous financial support.

Their gifts to the institution were made over a period of many years, and included a grant made by the older Mr. Baker in 1912 to bring about the hospital's teaching affiliation with Cornell University Medical College, and donations by both father and son in 1927 toward the incorporation of the Lying-In Hospital in the new medical center.

DEDICATION OF THE TECHNOLOGICAL INSTITUTE OF NORTHWESTERN UNIVERSITY

NORTHWESTERN UNIVERSITY will dedicate on June 15 and 16 its new Technological Institute, built at a cost of $6,735,000.

The engineering and science laboratories, which have just been completed, already are engaged in extensive research and training for the government's war effort. This essential work will continue uninterrupted during the dedication. The place of engineering during the war and afterwards will be the subject of the dedicatory ceremonies.

Among the facilities in the new building are an artificial river for testing ship models and wave action; a 1,500,000-volt surge generator; cold rooms for research at extremely low temperatures; a 1,000,000-pound transverse-universal testing machine two and a half stories high; the quietest room in the world; an explosion-proof room for the study of gases under high pressure; and a 5,000,000-pound hydraulic testing machine. More than $1,000,000 worth of equipment is already in use for teaching and research. Adequate room for expansion has been allowed in all departments.

The building dominates the aerial view of Chicago's North Shore. More than 500 feet long and 347 feet deep, it has a floor area of 423,000 square feet—which makes it larger than all the other academic buildings on the Evanston campus combined, and one of the largest educational buildings in the country. It looks like two letter E's laid back to back and joined by a central structure. There are six wings, each of which

is occupied by one of the six departments, physics and chemistry of the College of Liberal Arts, and civil, mechanical, electrical and chemical engineering.

Established through a gift from Walter P. Murphy, inventor and manufacturer of railroad supplies, the institute was opened in 1939 and moved into its new building last fall. When it is fully under way it will have an enrolment of 900 men, all pursuing a five-year cooperative course which calls for alternating a three-month period of study in the classroom with an equal period of work in industry. This plan is designed to train the student in practical as well as theoretical engineering; to assist industry in training its future executives, and to assist boys with limited means to gain technical education.

Students are now employed in the plants of seventy cooperating firms in various parts of the country. They are placed in jobs related to their chosen field of engineering and remain with the same firm throughout their course, after which they are engaged as full-time employees and have the benefit of their experience. Wherever possible the job is with a firm in the student's home town, so that he may live at home. Students are paired to replace each other each quarter, so that the job in industry is always filled.

At the dedication ceremonies, the principal addresses will be made by Donald Nelson, head of the War Production Board; Charles F. Kettering, president of the General Motors Research Corporation; Lieutenant General William Knudsen, member of the advisory War Production Board; and Jesse Jones, U. S. Secretary of Commerce. More than 800 representatives of industry, railroads, educational institutions and business will attend. Two hundred sixty-three industrial and business leaders are members of the honorary advisory committee for the event.

NATIONAL RESEARCH COUNCIL FELLOWSHIPS IN THE NATURAL SCIENCES

THE National Research Fellowship Board in the Natural Sciences of the National Research Council has made the following fellowship appointments for the academic year 1942–1943:

Harry Gregory Albaum (Ph.D., biology, Columbia University, 1938). To work at the University of Wisconsin on the relation between metabolism and growth in higher plants.

Thomas Hunter Allen (Ph.D., zoology, State University of Iowa, 1941). To work at the University of Chicago on "Does activation involve splitting of protyrosinase?"

Elizabeth Jean Armstrong (Ph.D., geology, Bryn Mawr College, 1939). To work at Columbia University on the conditions governing the formation of quartz crystals.

Elkan Rogers Blout (Ph.D., chemistry, Columbia University, 1942). To work at Harvard University on the structure of Yohimbine.

Robert Thornton Brumfield (Ph.D., botany, Yale University, 1942). To work at Harvard University on cell-lineage studies in plant organs by means of x-ray-induced chromosome rearrangements.

Victor Alexander Drill (Ph.D., physiology, Princeton University, 1941). To work at Northwestern University on the specificity of liver function tests in the detection of hepatic damage produced by various experimental procedures and the relation of the damage to the Kupfer cells.

Harry Emmett Gunning (Ph.D., physical chemistry, University of Toronto, 1942). To work at Harvard University on the conductance of dilute solutions of electrolytes.

Daniel Lambert Harris (Ph.D., zoology, University of Pennsylvania, 1942). To work at the University of California on a physical and chemical analysis of the structural elements of protoplasm.

Julius David Heldman (Ph.D., physical chemistry, Stanford University, 1942). To work at the University of California on kinetic and equilibrium studies of the homogeneous catalytic isomerization of paraffin hydrocarbons.

William Albert Hiltner (Ph.D., astronomy, University of Michigan, 1942). To work at the McDonald Observatory of the University of Texas on a photometric atlas of typical stellar spectra.

Byron Robinson Houston (Ph.D., plant pathology, University of California, 1939). To work at the University of Wisconsin on a physiologic comparison of strains of *Corticium solani*. The correlation of morphology, nutritional requirements and pathogenicity with special reference to the basidial stage.

Hugh McKinney Hulburt (Ph.D., physical chemistry, University of Wisconsin, 1942). To work at Princeton University on the kinetics of chemical reactions in flow systems.

Nathan Kornblum (Ph.D., organic chemistry, University of Illinois, 1940). To work at Harvard University on a stereochemical study of the forces existing between electrostatically charged groups in the same molecule.

Howard Levi (Ph.D., mathematics, Columbia University, 1942). To work at the Institute for Advanced Study on ideals of differential polynomials.

Joseph Carl Robnett Licklider (Ph.D., psychology, University of Rochester, 1942). To work at Harvard University on the effects of previous acoustic stimulation upon sound localization.

Charles Duncan Michener (Ph.D., entomology, University of California, 1941). To work at Harvard University and the Massachusetts State College on the comparative morphology and evolution of the abdominal appendages of insects.

Foil Allan Miller (Ph.D., chemistry, the Johns Hopkins University, 1941). To work at the University of Minnesota on the Raman and infrared spectra of some compounds of biological importance.

Francis Eugene Randall (Ph.D., biology, Harvard Uni-

versity, 1942). To work at the Western Reserve University on the relationships of the bony and fleshy noses in man and their reconstruction possibilities.

Herschel Roman (Ph.D., genetics, University of Missouri, 1942). To work at the California Institute of Technology on (1) problems of gene action; (2) the location of genes in the physical chromosome.

Arnold Hicks Sparrow (Ph.D., cytology, McGill University, 1941). To work at Harvard University on an investigation of chromosome mechanics with the aid of colchicine and x-ray-induced changes.

Luther Irwin Wade, Jr. (Ph.D., mathematics, Duke University, 1941). To work at the Institute for Advanced Study on a study of arithmetic properties of polynomials in a Galois field and related functions.

Harold Francis Weaver (Ph.D., astronomy, University of California, 1942). To work at the Yerkes Observatory on stars in galactic clusters showing anomalous K-line intensities.

Alvin Martin Weinberg (Ph.D., mathematical biophysics, University of Chicago, 1939). To work at Columbia University on the physico-mathematical aspects of nerve structure and function.

Alma Joslyn Whiffen (Ph.D., botany, University of North Carolina, 1941). To work at Harvard University on the nutrition and life histories of the Chytridiales.

THE AMERICAN ACADEMY OF ARTS AND SCIENCES

AT the annual meeting of the American Academy of Arts and Sciences, held at its house, 28 Newbury Street, Boston, on May 13, one new foreign honorary member, Lorenzo R. Parodi, of Buenos Aires, and twenty-one new fellows were elected.

Those elected in the natural and exact sciences were:

Mathematical and Physical Sciences: Wilmer Lanier Barrow, the Massachusetts Institute of Technology; Francis Birch, Harvard University; Samuel Cornette Collins, the Massachusetts Institute of Technology; Otto Struve, director, Yerkes Observatory.

Natural and Physiological Sciences: William Irving Clark, Worcester; Russell Gibson, Harvard University; Samuel Albert Levine, Harvard Medical School; William Ralph Maxon, U. S. National Museum; Hermann Joseph Muller, Amherst College.

The officers elected for 1942–1943 were:

President, Harlow Shapley; *Vice-president* for Class I, Percy W. Bridgman; *Vice-president* for Class II, S. Burt Wolbach; *Vice-president* for Class III, Sidney B. Fay; *Vice-president* for Class IV, Fred N. Robinson; *Corresponding Secretary,* Abbott P. Usher; *Recording Secretary,* Hudson Hoagland; *Treasurer,* Horace S. Ford; *Librarian,* Frederick H. Pratt; *Editor,* Robert P. Blake.

The meeting was addressed by Dr. Mark Graubard, who spoke on "Morale for a Democratic Offensive."

THE AMERICAN PHILOSOPHICAL SOCIETY

AT the annual general meeting of the American Philosophical Society held in the hall of the society in Philadelphia on April 23, 24 and 25, Dr. Edwin G. Conklin, of Princeton University, was elected president, and Dr. Frederick P. Keppel, president, retired, of the Carnegie Corporation, was elected a vice-president. Leicester B. Holland, Class IV, was elected a councilor to fill the unexpired term on the council of F. P. Keppel. *Members elected to the council* to serve for three years: Class I, C. E. Kenneth Mees; Class II, Douglas Johnson; Class III, Roland S. Morris; Class IV, Campbell Bonner.

Officers reelected were: *Vice-presidents,* William E. Lingelbach and Frank Aydelotte; *Secretaries,* W. F. G. Swann and Benjamin D. Meritt; *Curator,* Albert P. Brubaker; *Treasurer,* Fidelity-Philadelphia Trust Company.

Thirty resident members were elected. Those in the natural and exact sciences were:

Mathematical and Physical Sciences: Oliver Ellsworth Buckley, New York, N. Y.; Lee Alvin DuBridge, Rochester, N. Y.; Duncan Arthur MacInnes, New York, N. Y.; Robert Raynolds McMath, Pontiac, Mich.; Francis Dominic Murnaghan, Baltimore, Md.; Harald Malcolm Westergaard, Cambridge, Mass.; Robert Runnels Williams, Summit, N. J.

Geological and Biological Sciences: Leonard Carmichael, Medford, Mass.; Theodosius Dobzhansky, New York, N. Y.; Edward Adelbert Doisy, St. Louis, Mo.; Carl Owen Dunbar, New Haven, Conn.; Louis Otto Kunkel, Princeton, N. J.; Thomas Milton Rivers, New York, N. Y.; Lewis Hill Weed, Baltimore, Md.

Eight foreign members were elected as follows:

Harold Spencer Jones, Greenwich, England; Hendrik Anthony Kramers, Leiden, Netherlands; Ivan Matveitch Vinogradov, Moscow, U.S.S.R.; Octavio Méndez-Pereira, Panama City, Panama; Richard Henry Tawney, London, England; Paul van Zeeland, Brussels, Belgium; Amado Alonso, Buenos Aires, Argentina; William A. Craigie, Oxford, England.

SCIENTIFIC NOTES AND NEWS

THOSE receiving honorary degrees at the hundred and seventy-sixth anniversary of Rutgers College include Dr. Vannevar Bush, president of the Carnegie Institution of Washington, and Dr. Thomas Parran, Jr., surgeon general of the U. S. Public Health Service.

THE doctorate of science was conferred on May 19 at the commencement exercises of Brown University

on Dr. Arthur F. Buddington, of the Class of 1942, professor of geology at Princeton University.

THE Arthur Hoyt Scott Garden and Horticultural Award of a gold medal and cash prize of $1,000, which was awarded to Dr. C. Stuart Gager, director of the Brooklyn Botanic Garden, in 1941, will be presented to him on the occasion of the opening, on May 23, of a new open-air theater at Swarthmore College. Dr. Gager will make the dedication address, speaking on "Theaters, Gardens, and Horticulture." The 1942 award will be presented to Richardson Wright, editor of *House and Garden,* chairman of the board of the Horticultural Society of New York and chairman of the International Flower Show.

DR. JOSEPH A. BECKER, research physicist of the Bell Telephone Laboratories, was presented on May 3 with the Mendel Medal of Villanova College, in recognition of his contributions to the thermal emission of electrons and to the behavior of electrons at rectifying junctions.

AT the annual meeting in Cincinnati on April 15 of the American Association of Industrial Physicians and Surgeons, the W. S. Knudsen Award was presented to Dr. Clarence D. Selby, Detroit, since 1935 medical consultant to the General Motors Corporation, for "the most outstanding contribution to industrial medicine."

DR. W. V. CRUESS, head of the fruit products laboratory of the College of Agriculture of the University of California, has been awarded the first Nicholas Appert Medal of the Institute of Food Technologists. It will be presented to him on June 16 at the annual convention of the institute in Minneapolis. The medal will be awarded annually for "outstanding contributions to the development of improved food preservation methods."

THE Melchett Medal of the British Institute of Fuels for 1942 has been awarded to Dr. Arno Carl Fieldner, head of the technological branch of the U. S. Bureau of Mines in Washington.

THE Jacksonian Prize for the year 1941 of the Royal College of Surgeons, London, has been awarded to W. Bremner Highet, of the Wingfield Morris Orthopaedic Hospital, for his essay on "Injuries to Peripheral Nerves, with Especial Reference to the Late After Results." The John Tomes Prize for the years 1939–41 has been awarded to R. V. Bradlaw, for his work on the microscopical structure of the dental tissue.

THE James Alfred Ewing Medal for 1941 has been awarded to Dr. F. W. Lanchester, consulting engineer and technical adviser to various corporations, on the joint recommendation of the presidents of the Royal Society and the British Institution of Civil Engineers. The medal is awarded annually for research work in the science of engineering.

Nature reports that the following awards for the year 1941 were made on March 27, at the annual corporate meeting of the Institution of Chemical Engineers: The Osborne Reynolds Medal, for meritorious work accomplished for the advancement of the institution during the year, to Dr. A. Parker, honorary editor and recorder of the institution; the Moulton Medal (in gold), for the best chemical engineering paper of the year, read before the institution and published in the *Transactions,* to P. Parrish, for his paper, "Modern Developments in the Design of Plant for the Concentration of Sulphuric Acid"—the Junior Moulton Medal for 1941 was not awarded; the William Macnab Medal, for the best set of answers submitted in the associate-membership examination during the year, to E. W. Pates.

DR. ESMOND R. LONG, professor of pathology at the University of Pennsylvania and director of the laboratories of the Henry Phipps Institute, president of the Association for the History of Medicine; and Dr. Henry E. Sigerist, director of the Institute of the History of Medicine at the Johns Hopkins University, have been elected honorary members of the Society for the History of Medicine at Buenos Aires.

DR. ROY C. NEWTON, vice-president in charge of the Research Laboratories of Swift and Company, has been elected chairman of the Chicago Section of the American Chemical Society.

DR. WILLIAM T. CALDWELL, chairman of the department of chemistry of Temple University, has been named dean of the College of Liberal Arts.

AT Columbia University, Dr. W. Duncan Strong has been promoted to a professorship of anthropology and Dr. Arthur W. Pollister to an associate professorship of zoology. Dr. Fred S. Keller has been named assistant professor of psychology and Dr. Jerome M. B. Kellogg, assistant professor of physics.

DR. JACQUES P. GRAY, a unit director of the Michigan Community Health project of the W. K. Kellogg Foundation, has been appointed, effective on July 1, professor of preventive and public health medicine and dean of the Medical College of Virginia at Richmond. Dr. Lee E. Sutton, Jr., who has been dean for the past ten years, will continue as professor of pediatrics.

DR. W. VANN PARKER, since 1936 a member of the department of mathematics at the Louisiana State University, will succeed in the autumn as head of the department Professor S. T. Sanders, who has been a member of the faculty for forty years, and will retire, having reached the age limit of seventy years.

DR. CARL O. DUNBAR, professor of paleontology and stratigraphy at Yale University and curator of invertebrate paleontology at the Peabody Museum, has been named director of the museum. He will succeed Albert E. Parr, who has been appointed director of the American Museum of Natural History, New York. Daniel Merriman has been promoted from instructor to assistant professor of biology and will become curator of the Bingham Oceanographic Collection, a position which Mr. Parr also held.

DR. WILLIAM H. HOBBS, professor emeritus of geology at the University of Michigan, has been appointed a consultant of Far Eastern Affairs for the Office of the Coordinator of Information, Washington, D. C. The appointment is a result of his knowledge of the Japanese mandated islands of the Pacific. When carrying on geological research work in the West Pacific, Dr. Hobbs, on his trip in 1921, yisited and made studies of Bonin, the Sulphurs, the Carolines, the Pelews, Yap and other Japanese mandated islands as well as Japan, North Borneo, the Macassar Straits, Java, Sumatra and Rangoon.

DR. CHARLES E. REED, assistant professor of chemical engineering at the Massachusetts Institute of Technology, has joined the staff of the Research Laboratory of the General Electric Company at Schenectady, N. Y., as consulting chemical engineer.

DR. CHARLES GALTON DARWIN, director of the National Physical Laboratory, has been named scientific adviser to the British Army Council.

PROFESSOR JAMES A. SCOTT WATSON has been appointed by the British Government to the posts of agricultural attaché on the staff of the British Ambassador to the United States and agricultural adviser to the High Commissioner for the United Kingdom in Canada. These offices have been established to secure the closest possible contacts on current and future agricultural problems of Great Britain, the United States and Canada.

A CORRESPONDENT writes: "Most unfortunately, the press and radio mentioned several times in mid-April a rumor that Dr. Carrel was being considered for a place on the Laval cabinet as Minister of Health. It is particularly regrettable that no correction was made in the press when the final cabinet was announced, and another man, Dr. Grasset, was named Minister of Health. At considerable personal sacrifice, Dr. Carrel has remained in France to do what he can to help the people in their extremity. His friends are greatly distressed at the linking of his name with the Laval government."

DR. FRANCIS PERRIN, professor of theoretical physics at the Sorbonne, Paris, now visiting professor at Columbia University, gave on May 8 the John Howard Appleton Lecture at Brown University, in conjunction with the Rhode Island Section of the American Chemical Society. He spoke on "Nuclear Energy."

UNDER an exchange lecture arrangement between the Michigan College of Mining and Technology and the University of Michigan, Professor A. K. Snelgrove, of Michigan College, head of the department of geological engineering and member of the Committee on Mining Geology of the American Institute of Mining and Metallurgical Engineers, delivered recently at Ann Arbor a series of addresses on "Geological Prospecting Criteria." Associate Professor A. J. Eardley, of the University of Michigan, discussed oil geology, Cordilleran structures and tactical and geological interpretation of aerial photographs in his lectures at Houghton.

THE usual courses in spectroscopy will not be given at the Massachusetts Institute of Technology this summer.

THE third annual meeting of the Southeastern Section of the Botanical Society of America will be held on June 12, 13 and 14 at Knoxville, Tenn., with the University of Tennessee as the host institution. The program will include trips to the TVA laboratories and tree crop nursery at Norris, the Agricultural Experiment Station of the University of Tennessee and the Great Smoky Mountains National Park. A discussion of the vegetation of the Great Smoky Mountains will be led by Dr. S. A. Cain and Dr. A. J. Sharp, of the department of botany. Dr. Cain will discuss "The Tertiary Nature of Southern Appalachian Forests," and Dr. Sharp will speak on "Highlights of the Southern Appalachian Flora." Dr. W. H. Camp, of the New York Botanical Garden, will lecture by invitation on "The Origin and Genetic Structure of Species."

THE Association for the Study of Internal Secretions announces the establishment of the Ciba Award to recognize the accomplishment of an investigator not more than thirty-five years of age in the field of endocrinology. Work cited may be either in the field of preclinical or clinical endocrinology. The award is for $1,200. If the recipient should choose to use the award toward further study in a laboratory other than that in which he is at present working, it will be increased to $1,800. The option is left entirely to the recipient. Choice of the recipient is in the hands of the committee of awards of the association, composed of five members.

THE Office of Psychological Personnel has been established by the American Psychological Association under the auspices of the Division of Anthropol-

ogy and Psychology of the National Research Council, to be concerned with the maximum, effective utilization of psychologists in the war effort. This office is continuing and extending the work begun last year by the Subcommittee on the Listing of Personnel in Psychology, of which Dr. Steuart Henderson Britt is chairman. Dr. Britt is now serving as executive director of the Office of Psychological Personnel and may be addressed at the National Research Council, 2101 Constitution Avenue, Washington, D. C.

A NATIONAL Registry of Rare Chemicals has been established by the Armour Research Foundation. Information on chemicals too rare to be listed in the catalogues of regular chemical supply houses will be filed with the registry and indexed according to name, location and amount available. Dr. Martin H. Heeren, chairman of chemical engineering research, has been appointed director. Chemicals to be found in the catalogues of supply houses are not included, but all those not available through regular channels will be listed. The file will be regarded as confidential and will not be open to general inspection. Specific inquiries will be answered by the registry. In transactions in which the owner of the chemical wishes to remain anonymous to prevent the disclosure of commercial secrets, the registry will act as intermediary.

DISCUSSION

GRAVEL OUTWASH NEAR CHILLICOTHE, OHIO

THE occurrence of Illinoian gravel at two markedly distinct levels on the border of the Scioto Valley, near Chillicothe, Ohio, though known for many years, seems not to have been given a satisfactory interpretation. There are quite extensive deposits of the gravel directly east of Chillicothe at an altitude of 800 to 860 feet, or 200 to 250 feet above the flood plain of the Scioto River. Directly south of these deposits on ground only 700 to 740 feet there is a sheet of glacial gravel showing a similar degree of weathering. They both are regarded as an Illinoian outwash by the several geologists who have observed them. They were noted by M. R. Campbell in 1918 in a description of the country around Camp Sherman printed on the back of the Camp Sherman map, and the suggestion made that two lobes of the Illinoian ice sheet, one occupying the Scioto Valley and the other Walnut Creek, met and enclosed between them the ground carrying the high gravel deposits. The lobes then became separated and exposed the ground to the south where the lower deposits are located. This interpretation was cited by J. E. Hyde in his report on the Camp Sherman Quadrangle.[1] But he decided that it was not to be accounted for by such localized conditions, as the deposit extends far up Walnut Creek. He noted that the upper limits of these gravels are nearly identical with Illinoian gravels on Paint Creek and its tributaries west of the Scioto Valley, and likely to have been determined by wide-spread common condition. He also found the lower set of gravels to have a distribution far down the Scioto Valley. But he failed to find a satisfactory explanation of the occurrence of the two sets of deposits at such markedly different levels.

The Cincinnati ice blockade of the Ohio River in the Illinoian stage of glaciation has been pretty fully established in the geological literature for more than fifty years. The ponding that it is assumed to have produced above the site of the ice dam has also been under discussion from the first. In 1890 the Beech Flats of northwestern Pike County, only 25 to 30 miles southwest from Chillicothe, were found by G. F. Wright to carry silt deposits at a level similar to the highest gravel deposits under discussion, and were interpreted by him to be due to the ponding by the Cincinnati ice dam.[2] It therefore seems natural to look to this ice blockade of the Ohio for the explanation of the features under consideration. It seems very probable that we have in the higher set of gravel deposits a close relation to the giving way of the ice dam. That they fill a space of fully 50 feet in altitude, and are of gravel with some interbedding of silt, seems a natural condition attending the breaking of the blockade, with some fluctuation in the height of the ponding. An interval of some years may have been involved in the complete clearing of the blockade. The lower set of deposits in the Scioto Valley probably dates from the practical disappearance of the obstruction of the Ohio River in the vicinity of Cincinnati. The distribution of the gravel far down the Scioto shows a free drainage, inconsistent with the presence of an obstruction in the Ohio valley. It is a matter of especial interest that we seem to have in these two sets of deposits decisive evidence that the Illinoian ice held possession of the Scioto Valley as far down as Chillicothe after the blockade of the Ohio had been lifted.

A few words seem pertinent as to the pre-Illinoian trenching of the Scioto Valley. Well records presented by Professor Hyde in his report on the Camp Sherman area show the bedrock in Chillicothe and

[1] *Bull.* 23, Geol. Survey of Ohio.

[2] *Bull.* 58, U. S. Geol. Survey, pp. 92–96. 1890.

points above that city to have been trenched to a level fully 100 feet below the present stream, or to less than 500 feet above sea level. The filling with gravel to 700 feet thus shows an aggradation of about 200 feet.

FRANK LEVERETT

ANN ARBOR, MICH.

AVERAGE HEIGHT OF AMERICAN MEN

RECENT articles in SCIENCE have left the reader with a certain amount of skepticism as well as a large amount of thought-provoking data.

In the December 12 issue of SCIENCE (Vol. 94, No. 2450, pp. 552–553) Leonard R. Rowntree gives an average height of over 2,000,000 registrants examined as 67½ inches, the identical average of men in World War I. An increase in weight of 8 pounds was shown.

In the January 13 issue of SCIENCE (Vol. 95, No. 2454, *Supplement*, p. 13) Dr. Laurence B. Chenoweth and Richard G. Canning found that of 10,005 students of the University of Cincinnati born between 1904 and 1921, the average height of freshmen in 1916 was 67.5 inches; in 1936 it had increased to 69.9 inches; and that no increase in average size had occurred since 1936. Not only has the size of man increased, the scientists say, but children are growing more rapidly.

To this reader the foregoing statements are very contradictory unless the increased weight of registrants as shown by Rowntree can be assumed to be increased size. Even with this assumption, the conclusions drawn by Chenoweth and Canning that the size of man has increased and children are growing more rapidly is only half substantiated by Rowntree's observations.

Not having available the full text of either report it may be premature on my part to comment; nevertheless, outwardly there appears to be a false hypothesis on the part of Chenoweth and Canning, not on the data obtained, but as a result of the population from which their sample was drawn. Since their sample was only representative of those individuals who no doubt had, through the force of circumstances, been given greater or higher privileges as children, as evidenced by their university attendance, it should not have been used to draw the general conclusions given. In Rowntree's sample of 2,000,000 individuals, taken from all walks of life and from all sections of the United States, it would seem that we have a most complete and uniform distribution, and the odds that the average is a true average are very great. He shows no growth in height from 1916 to 1941, but does show an increase in weight.

These observations would lead one to conclude that the childhood care and advantages, which result in increased growth, are much greater for those students in the University of Cincinnati than for the United States as a whole, and that any conclusions drawn by Chenoweth and Canning should be confined and not generalized.

The most interesting and enlightening article, "Life in the Andes and Chronic Mountain Sickness," by Dr. Carlos Monge, University of San Marcos, Lima, Peru (SCIENCE, Vol. 95, No. 2456, pp. 79–84) would appear to be of value to our officers of the Army, Navy and Air Corps. The strength, lung and heart reactions of the Andean man is certainly something to be reckoned with. It indicates there is possibly a selective area in the United States from which men for certain types of combat and for combat in certain types of terrain could or should be drawn. We have in this country men coming from sea-level to elevations of several thousand feet. Very few have probably been reared at elevations above 6,000 to 7,000 feet, but many have been reared in elevations of 2,000 to 5,000 feet, and their heart, lung and strength reactions would possibly be in a more or less direct ratio to the elevation in which they were reared.

Have our commanding officers given any thought to grouping these men according to their branches of service and to the possible combat areas in which they are to serve? Would not a grouping of our men from coastal areas or sea-level and from the areas of higher altitudes give greater efficiency to our armies?

After reading the latter article by Dr. Monge it was recalled that Rowntree showed that 7 of 10 men from Colorado were accepted as physically fit for service, but only 3 of 10 from one of the southern states. The elevation of Colorado may or may not be a factor, but it does give food for thought to the layman.

In conclusion, I should like to see Dr. Monge's article stripped of its more technical terms, written in a more popular vein so that the layman could better understand it fully and published for distribution. It is believed that many people would derive as much pleasure and information from reading it as I have.

S. L. CALHOUN

LELAND, MISSISSIPPI

A CASE OF "WINE-FED" TERMITES

DURING the summer of 1937, a wine dealer was alarmed at the leaking of wine from wooden boxes packed on the floor of his concrete vault. On examination of the cases, insects were found and immediately an exterminator was called in to investigate the situation. The exterminator brought a leaking case of the imported wine to the writer, who identified the "bootleggers" as *Reticulitermes flavipes* Kollar. Several of the bottles had the lead foil, sealing the neck and cork, eaten through, as well as the corks punctured. There were no insects drowned in the wine, but the straw jackets covering the bottles were alive with soldiers

and workers both young and old. Two wine-soaked jackets along with several hundred specimens were sealed in a rectangular museum jar. The jar was placed in the dark and periodically examined. When brought into the light the specimens began to coat the jar, so that, after a time the four sides were coated with a clay-like substance. It was a lively, interesting sight to see the specimens running through the tunnels made in the material coating the glass. Over a period of four years, there were no swarms, although many young specimens were observed. No mold was formed, as is often the case when cultivating termites in the laboratory. The end came when the food was consumed.

JAMES A. MULLEN

FORDHAM UNIVERSITY

SCIENTIFIC INTUITION OF A ROMAN EPICURE. A QUOTATION

THE appended quotation[1] from Petronius, Rabelais' prototype at Nero's court, is peculiarly timely to-day:

"But tell us," said Trimalchio, "what was the bill of fare?"

"All right," he replied, "I'll tell you if I can: my memory is so brilliant that I often forget my own name. However, to begin with, we had a roast pig crowned with a wine-cup; this was set off by cheese-cakes and forcemeat done to a nicety; then of course beetroot *and pure whole-meal bread, which I prefer to white bread as being more feeding and better for my liver.*"

W. A. PERLZWEIG

DUKE UNIVERSITY SCHOOL OF MEDICINE

QUOTATIONS

DISEASE IN WARTIME[1]

MALARIA

BECAUSE it includes one of the recently acquired military bases of the United States, Trinidad takes on new importance to this country. At the request of the Army and Navy and on the invitation of the Government of Trinidad, the Rockefeller Foundation is participating in a study of malaria in the civilian population of that island. Malaria is the outstanding health problem there, and while the identity of the principal vectors responsible for the disease in Trinidad has not been definitely established, evidence points to two species of anopheline mosquitoes. One of these species breeds in the water which collects in the leaves of a plant growing on trees. Malaria is thus often prevalent in regions where the usual marshes and streams, commonly associated with the disease, are absent, and this probably accounts for the fact that malaria is found at nearly all altitudes in Trinidad. The Foundation has assigned a malariologist and an entomologist to determine the factors of the problem, and when these have been obtained it will be possible to make intelligent plans for controlling the disease.

Another project in malaria under Foundation auspices is on the Burma Road. This project was begun in 1940 under the direction of Dr. W. C. Sweet of the Foundation staff. On one section of the Road, troops and truck drivers became heavily infected with malaria a short time after their arrival, and investigations were begun at that point. More than twenty species of anopheline mosquitoes were found in this area, but only one proved to be an effective carrier of the disease. A laboratory has been established directly on the Road, and although under the war circumstances the project has encountered great difficulties, it is hoped that effective control measures will soon reduce the incidence of malaria at this critical section of the highway.

TYPHUS

"In its tragic relationship to mankind," said Hans Zinsser, "the disease of typhus is second to none—not even to plague or to cholera." In most major wars of the past more persons have succumbed to typhus than have fallen on the battlefield—and Zinsser speaks of "the relative unimportance of generals." Whether a similar disaster will accompany this war we do not know, but typhus is now active in many parts of Europe. Epidemics are building up in southern Spain. Other known focuses of the disease are in Poland, Rumania and the neighboring countries, whence it may be expected to spread in disastrous epidemics as the result of conditions imposed by prolonged warfare.

In spite of the fact that it is an age-old problem, our basic knowledge regarding this disease is far from adequate. We know in a general way that it is spread from person to person by means of the body louse and that it develops rapidly with devastating results when people are crowded together under unsanitary conditions and when there is a heavy louse infestation. We also know that in most instances one attack confers lifelong immunity, and we have certain rudimentary knowledge regarding the prevention of its spread by such measures as general delousing and quarantine. But we do not know how

[1] From the Review for 1941 of the Rockefeller Foundation by President Raymond B. Fosdick.

[1] Chapter LXVI, "Petronius: The Satyricon." Translated by J. M. Mitchell. London: J. M. Rutledge and Sons, Ltd.; New York: E. P. Dutton and Company, 1923.

best to control or eradicate louse breeding under war conditions. Nor has there been found any highly effective or reliable method of immunization against typhus. Moreover, no specific treatment for the disease, once it is contracted, has thus far been discovered.

The chief reason that so little progress has been made in the study of this malady is the lack of an experimental animal which would equal man in its susceptibility to typhus, and in which the disease could be reproduced as it occurs in human beings. Until such an animal is found, progress in the study of typhus is bound to be slow. In the past the standard animal employed for this purpose has been the guinea pig, but in comparison with man the susceptibility of the guinea pig to typhus is slight. The infection in this animal is usually characterized by a short transitory period of fever followed by recovery. There has been a tendency to believe that the various preventive measures effective in the comparatively refractory guinea pig are equally effective in the highly susceptible human being. The hazards of such reasoning were recently demonstrated when vaccines which fully protected guinea pigs failed to afford similar protection to laboratory workers exposed to infection due to accident. Two doctors on the staff of the Rockefeller Foundation contracted typhus this last year, although they had been vaccinated with the latest and supposedly the most effective type of vaccine.

The International Health Division of the Rockefeller Foundation began laboratory research in typhus in January, 1941, and soon afterward a field worker was sent to Spain to study on the ground the epidemic active in that country. Some progress was made during the year in finding a better tool for typhus research in the form of a more susceptible animal. This proved to be the Eastern cotton rat, previously used in the United States in the investigation of infantile paralysis. These rats are highly susceptible to European typhus, but only when very young. During the period when they are expected to develop immunity as a result of vaccination, they also acquire a certain degree of natural resistance by simply growing up. On the other hand, they have proved extremely valuable in facilitating comparison of different vaccines as well as in the study of chemotherapy in typhus.

Although the cotton rat is greatly superior to the guinea pig for typhus studies, the search for a still better experimental animal is being continued. Ever since 1938 field workers of the Foundation's International Health Division have been collecting and testing wild animals for their susceptibility to virus diseases, particularly in the jungles of Brazil and Colombia, on the island of Jamaica and in Africa. The previous discovery of the value of the ferret in influenza and the hedgehog in yellow fever suggested that other animals might be discovered if a systematic search were made. It is to be hoped that some animal more susceptible than the cotton rat will soon be found so that advance in knowledge of typhus can be hastened.

INFLUENZA

A year ago in this Review a report was made of the development of a vaccine for influenza A and of the field studies then in progress, both in this country and in England, to determine its efficacy. These studies indicated that while the vaccine effected about a 50 per cent. reduction in the incidence of influenza A, it would have to be greatly improved in quality before it could really control the disease.

During 1941 the research was energetically pushed in relation not only to influenza A but to influenza B; and the laboratories of the Foundation were successful in developing a new technique for measuring antibodies in the blood before and after vaccination. Aided by this technique, eleven different types of vaccines have been prepared and tested in human volunteers in groups varying in size from 150 to 200 persons. Generally speaking, the number of antibodies in the blood of persons vaccinated with some of these types was about the same as that which would follow an actual attack of influenza.

On the basis of these results it was decided to make a field trial of one of the most promising vaccines containing both influenza A and B viruses. Groups of 1,000 persons have therefore been vaccinated in Oklahoma, Georgia, Virginia, Ohio and New York. All vaccinations have been done in large institutions where a similar number of persons living under identical conditions have been left unvaccinated, to serve as controls. At the moment no influenza has been reported anywhere in the United States. If this should be an "off year" for influenza, there may not be an opportunity this winter to test the efficacy of the new type of vaccine.

SCIENTIFIC BOOKS

THE LAPLACE TRANSFORM

The Laplace Transform. By DAVID VERNON WIDDER. x+406 pp. Princeton: Princeton University Press. 1941. $6.00.

THE Laplace transform has been extensively investigated by two classes of people—mathematicians and applied mathematicians. The latter have been chiefly interested in the formal properties of the

Laplace transform, which make it useful for obtaining solutions of physical problems; the former have been interested in embedding the formal properties in a mathematically satisfying logical structure. This book was written by a mathematician for other mathematicians, and contains no applications outside pure mathematics. However, it could serve as a useful source in which applied mathematicians might look for the properties which they need to use. The first chapter, which is the most convenient account of Stieltjes integrals yet to have appeared in a book, is also recommended to applied mathematicians. Stieltjes integrals, with their ability to handle both discrete and continuous cases at once, seem admirably suited for use in applied mathematics; however, up to the present time few applied mathematicians seem to have been aware of the potentialities of Stieltjes integrals. In this book the author uses Stieltjes integrals systematically, and is thus able to discuss both classical Laplace transforms and Dirichlet series as cases of the same general theory.

The book contains proofs of nearly all the auxiliary material which the author has used, and interesting applications of some of it to topics other than those strictly within the subject. Thus the theory of moment problems, introduced partly because a moment sequence is a discrete analogue of a Laplace transform and partly because some of the results are needed elsewhere in the book, is applied in a discussion of Hausdorff summability. Wiener's general Tauberian theorem (with Pitt's elegant proof) is applied not only to Tauberian theorems for Laplace transforms, but also to the prime number theorem (of which two proofs are given).

Other topics covered include regions of convergence of Laplace transforms; inversion formulas (both those involving contour integrals and those involving derivatives); necessary and sufficient conditions for the representation of functions as Laplace transforms; the iterated Laplace transform (or Stieltjes transform); absolutely and completely monotonic functions (no discussion of this last topic has previously been available in book form).

An experienced analyst will find in this book a large amount of useful material conveniently arranged and concisely expounded; a specialist will observe new theorems and new proofs of old theorems; a beginner will find important classical methods as well as problems at the frontiers of current research. The book contains ample refutation of the opinion, so frequently expressed nowadays, that "classical" analysis is a field in which interesting results are no longer to be expected.

R. P. BOAS, JR.

DUKE UNIVERSITY

MEDICAL PSYCHOLOGY

A History of Medical Psychology. By GREGORY ZILBOORG, M.D., in collaboration with GEORGE W. HENRY, M.D. 606 pp. New York: W. W. Norton and Company, Inc. 1941. $5.00.

THOSE students who have felt the need of a historical orientation in the subject of mental disorders are now presented with the first comprehensive history of medical psychology in any language. Valuable material of this character exists in brief articles distributed through the medical and philosophical literature of the ages, in Jelliffe's translation of Friedreich's writings, in Kannabich's history of psychiatry in Russian (1928), in the contributions of Calmeil, Lelut, Trélat and of the two Semelaignes, and in the essays of D. Tuke and T. Kirchhoff, but heretofore there has been no perspective offered in a systematized way.

Here one finds a description and an evaluation of the evolution of the concepts of mental suffering, of emotional illnesses and of personality disorders, along with the story of the whole development of culture and the struggle against mental illness.

To the primitive man, mental deviations were mysterious. They are still far from being well understood, and streaks of demonology are found at present in the midst of our modern culture and in the offshoots of our contemporary thinking. The section "Primitive and Oriental Medical Psychologies" contains the statement that mental disorder "whether viewed with the clouded vision of a very primitive man, through the mystic eyes of Mosaic law, or through the pantheistic glasses of the Hindu, remained a mystery, reprehensible or admirable, which did not belong to medicine."

It is pointed out that the first serious attempt to place mental disease on a scientific foundation was made by the Greeks, and in the section on the Greeks and the Romans the activities of Hippocrates, Plato, Aristotle, Cicero, Celsus and Aretaeus are emphasized. Galen, who added so much to the general medical knowledge of the times, is characterized as having "contributed nothing new either to the therapy or to the clinical description of mental diseases." Then came the "Great Decline," a period toward the end of the twelfth century when medical psychology as such became attenuated as a healing art and was gradually isolated from scientific consideration, almost to the point of extinction.

The sections entitled "The Restless Surrender to Demonology" and "The Blows of the Witches' Hammers" are among the most informative, constituting fascinating accounts of the current ideas and prac-

tices, including the incredible and horrible cruelty associated with "witch" trials and executions of those suffering from now-recognizable mental twists. The reaction from this state of affairs appears in the text as "The First Psychiatric Revolution," stressing among others the pioneer labors of Vives (1492–1540), Paracelsus (1493–1541), Cornelius Agrippa (1486–1535), Johann Weyer (1515–1588) and Jean Bodin (1530–1596), all of whom took active parts in attempts to unravel many complexities and to demonstrate that mental disorders were natural diseases and not the handiwork of the devil.

From the "Age of Reconstruction" during which there were many important creative movements, one is led to the period called "The Discovery of the Neuroses," at which time psychiatry was vitalized by the work of Mesmer, Braid, Charcot, Janet and a number of their contemporaries who had gained glimpses of the laws of the mind in action. The "Era of Systems" is described next, at which time the special trend in the direction of differentiation and classification of mental diseases was forwarded by the outstanding investigations of Esquirol, Falret, Tuke and Kraepelin.

The climax in this history of medical psychology is found in the "Second Psychiatric Revolution," which describes the researches and ideas of Sigmund Freud, psychoanalytic and other psychodynamic concepts, and their expansion into the various divisions of modern work and thought. The contributions of Adolf Meyer, A. A. Brill, W. A. White and S. E. Jelliffe are included here.

The history of the concepts of some of the organic mental disorders, such as general paresis, senile conditions and alcoholic reaction types has been ably presented by Dr. Henry. He has also contributed a very useful section on the history of the influences governing the building and organization of mental disease hospitals from the earliest times to the present, which includes the story of the dire conditions and sad state of the early asylums as compared with modern accommodations and humane treatment.

The approach is humanistic and the style of writing is spontaneous and vivid. Although it would require a number of volumes to include all the desirable details of the history of medical psychology, the book will take an important place in the literature of the medical sciences, where it will serve those interested in human psychology, and it should stimulate a demand for further expansion.

NOLAN D. C. LEWIS

COLUMBIA UNIVERSITY

SOCIETIES AND MEETINGS

THE SOUTHERN ASSOCIATION OF SCIENCE AND INDUSTRY

THE Georgia Academy of Science served as host at the second annual meeting of the Southern Association for the Advancement of Science at the Biltmore Hotel in Atlanta, on April 2 and 3. At this meeting it was agreed that the name of the organization be changed to The Southern Association of Science and Industry, in order that the participation of industrialists and business men in the organization might be more properly indicated.

With Dean Wortley F. Rudd, Medical College of Virginia, presiding, addresses were given before the association by Dr. W. B. Baker, Emory University, president of the Georgia Academy of Science, and Governor Eugene Talmadge, of Georgia. Dr. George H. Boyd, University of Georgia, president-elect of the association, spoke on "Some Basic Considerations in Building for Research in Southern Problems."

Panel discussions, open forums, etc., were conducted on important regional problems, and many southern and national leaders participated. Chairmen and topics of the various discussion groups included Dean C. F. Korstian, School of Forestry, Duke University, "Conservation of One of the South's Major Crops—Its Forests"; Dean Stewart J. Lloyd, University of Alabama, "The Teaching of Science in the Secondary Schools of the South"; Dr. Milton H. Fies, De-Bardeleben Coal Corporation, Birmingham, Alabama, "As Others See Us"; and Dr. J. Sam Guy, Emory University, "Role of Scientific Research in the Development of Natural Resources of the South." Dean Rudd delivered the presidential address, entitled "Remarks," at the banquet, on Thursday, April 2, at 8:00 P.M.

Certain business matters, such as the constitution, reports of standing and special committees, were considered and agreed upon. It was further agreed that the incoming president should appoint a "Long Range Planning Committee" and a committee to make a survey of all research now being carried on in the South. The president was requested to appoint a committee to consider the possibility of increasing a service such as is now being rendered by Dr. E. Emmet Reid through visitation and technical advice to the various research groups in the South.

The original territory was changed to include all of Texas, and, upon insistence by representative residents, it was agreed that Maryland and the District of Columbia be added for membership in the Southern Association of Science and Industry. Several state academies and other state and regional science or-

ganizations have requested that they be affiliated with the association.

Officers elected were:

President: Dr. George H. Boyd, University of Georgia.

President-elect: Dr. Milton H. Fies, DeBardeleben Coal Corporation.

Vice-president: Dr. J. Sam Guy, Emory University.

Treasurer: Dr. L. B. Roberts, Arkansas A. and M. College, Monticello.

Secretary: Dr. George D. Palmer, University of Alabama.

Members of the executive committee:

E. Morrell, Maryland; Dr. Austin Clark, District of Columbia; Major W. Catesby Jones, Virginia; Dean C. F. Korstian, N. C.; Dr. James E. Copenhaver, S. C.; Dean Robert C. Wilson, Ga.; J. H. Allen, Florida; Dr. James T. Mackenzie, Alabama; Dr. W. F. Hand, Miss.; Dr. H. A. Webb, Tenn.; Dr. M. Scherago, Kentucky; Dr. Richard J. Anderson, Arkansas; Dr. E. F. Pollard, La., and Dr. Edward O. Heuse, Texas.

GEORGE D. PALMER,
Secretary

SPECIAL ARTICLES

STEROID HORMONE EXCRETION BY NORMAL AND PATHOLOGICAL INDIVIDUALS

A STUDY is in progress of the abnormalities of the intermediary metabolism of the steroid hormones which are associated with disease. As a part of this program a systematic investigation has been initiated involving the examination of individual urine collections in amounts adequate for extensive fractionation and chemical characterization of the constituent steroids. This note presents the findings to date from the processing of 2- to 6-month collections of urine from six normal persons, six patients with cancer and four patients with clinical evidence of hyperplasia of the adrenal gland.

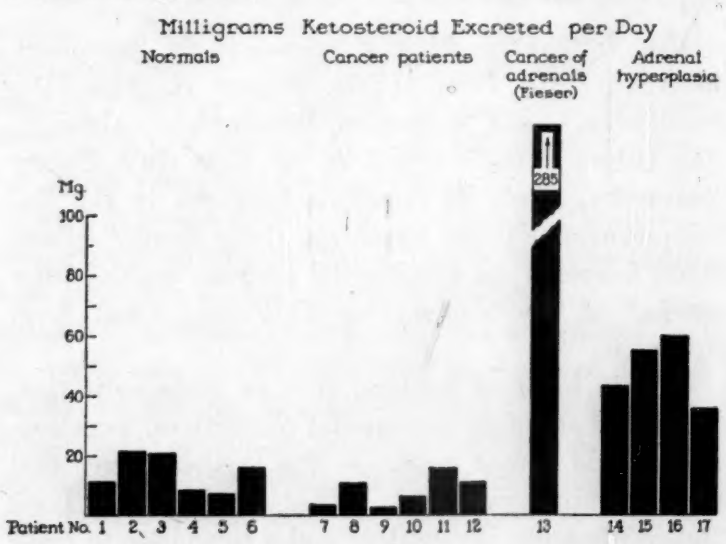

FIG. 1

After hydrolysis of the urine with sulfuric acid and extraction with ether, the extracts were partitioned into acidic, phenolic and neutral fractions. The neutral material next was separated with Girard's reagent (T) into ketonic and non-ketonic fractions. Each of these then was processed with digitonin into the 3-alpha- and 3-beta-ketosteroid fractions.

The 24-hour excretion rate of the total ketosteroids by the individuals studied, as estimated by the Callow modification[1] of the colorimetric method of Zimmermann,[2] are summarized in Fig. 1. Included for comparison are the results of a previous study (Fieser[4]). The cancer patients excreted, in general, smaller amounts than did the normal individuals and the patients with adrenal hyperplasia.

The average contents of digitonin-precipitated material (or 3-beta-hydroxy steroids) in the total ketosteroid fraction were: normals, 0.6–2.2 per cent.; cancer patients, 0.3–6.0 per cent.; patients with adrenal hyperplasia, 3.7–11.4 per cent. (Fig. 2).

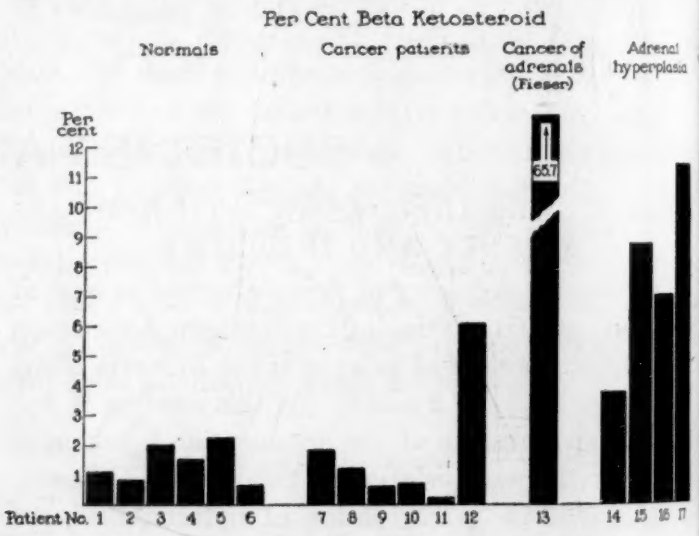

FIG. 2

The material not precipitated by digitonin (3-alpha-hydroxy-ketosteroids and 17-ketosteroids) was adsorbed from ligroin solution onto activated alumina (Brockmann) and separated by systematic fractional elution into the following fractions (Fig. 3):

Fraction I (elution with mixtures of petroleum ether and benzene). The presence in this fraction of $\Delta^{3,5}$-androstadienone-17[3,4] was demonstrated in the material from four of six normals and from all the patients with adrenal hyperplasia. This was done by the isolation of the semicarbazone and oxime and

[1] N. H. Callow, R. K. Callow and C. W. Emmons, *Biochem. Jour.*, 32: 1312, 1938.

[2] W. Zimmermann, *Z. physiol. Chem.*, 233: 1935; 245: 47, 1936.

[3] H. Burrows, J. W. Cook, E. M. F. Roe and F. L. Warren, *Biochem. Jour.*, 31: 950, 1937.

[4] J. K. Wolfe, L. F. Fieser and H. B. Friedgood, *Jour. Am. Chem. Soc.*, 63: 582, 1941.

[5] H. Hirschmann, *Jour. Biol. Chem.*, 136: 483, 1940.

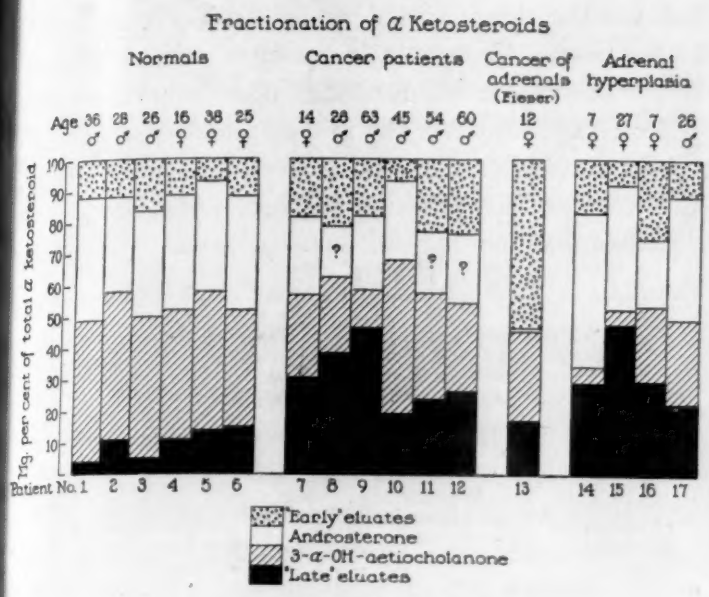

FIG. 3

by spectroscopic characterization. No chemical or spectroscopic evidence was found to suggest the presence of the dienone in urine collections from the two other normal individuals or from the patients with cancer. Androstenone-17[5, 6] was isolated from two normal urines and three hyperplasia urines (m.p. 114–114.5° C., $[\alpha]_D^{28} + 148°$ C.). It was identified by analysis and through the oxime. Androstenone-17 was not found in the urine of any cancer patient studied. The unidentified material of Fraction I had no characteristic ultraviolet absorption spectrum and gave no alcohol-insoluble semicarbazone.

The origin of the $\Delta^{3,5}$-androstadienone-17 found in hydrolyzed urines is being investigated, and preliminary results based merely upon the identification of the dienone in suitably processed fractions by its characteristic absorption spectrum indicate that the substance can be detected in extracts of certain unhydrolyzed urines. It also appears, from the spectroscopic evidence, that acid hydrolysis of a urine previously devoid of any detectable amount of $\Delta^{3,5}$-androstadienone-17, but to which dehydroisoandrosterone has been added, results in the production of a certain amount of the dienone.

Fraction II (elution with benzene and benzene-ether). Androsterone appears to be the chief constituent of this fraction. It was isolated from all collections except those from three patients with cancer (m.p. 177–178° C.). The androsterone was identified by analysis and by mixed melting point determinations of the hydroxyketone and its acetate with authentic samples. In Fraction II of the urine collections from the patients with evidence of adrenal hyperplasia certain apparently homogeneous substances were present which were not previously found in urine. One of these melts at 149–150° C., and another, isolated in amounts too small for analysis, melts at 134–135° C.

Fraction III (elution with ether and with ether containing 10 per cent. acetone). The chief constituent was identified as 3-alpha-hydroxyaetiocholanone-17 and was isolated in every instance (m.p. 143–144° C., remelting at 150° C., no depression in melting point on mixing the substance or its acetate with authentic samples).

Fraction IV (elution with ether-acetone, acetone and methanol). This fraction afforded a variety of substances. From two collections of normal urine and one of urine from a patient with evidence of adrenal hyperplasia there was isolated a substance, m.p. 199–200° C., which appears from the analysis to have the formula $C_{19}H_{32}O_3$ (Found: C, 74.30; H, 10.21). A second substance, m.p. 185–186° C., was isolated in traces from the urine of one patient with evidence of adrenal hyperplasia; it depresses the melting point of the 3-alpha-hydroxyandrostenone-17 isolated by Wolfe, Fieser and Friedgood[4] from the urine of a patient with adrenal tumor. A third substance, m.p. 232–234° C., was found in the urine of one cancer patient and, in larger amounts, in the material from three of the patients with adrenal hyperplasia. A fourth substance, m.p. 172–176° C., was isolated from the urine of a patient with evidence of adrenal hyperplasia, and other, so far impure, crystallizates have been encountered in this fraction.

Colorimetric assays were made of the total ketosteroid content of the four fractions of ketonic material not precipitated by digitonin. In the series of six normal urine collections, Fractions I and IV each constituted 5–15 per cent. of the total, and Fraction II (androsterone) and Fraction III (3-alpha-hydroxyaetiocholanone) together made up 70–90 per cent. of the total and were found present in the ratio 4:5. This finding is in confirmation of the observations of Callow and Callow.[7, 8] In the urine collections from patients with cancer the distribution of material was not as constant as in those from normal individuals and ratios between Fractions II and III were irregular. In three instances no androsterone was found in the Fraction II and, furthermore, Fractions I and IV were, with one exception, larger than normal. In the urines from adrenal hyperplasia patients, Fraction I usually contained 10–20 per cent. of the total ketosteroids, as was found in the material from normals, while Fraction IV contained distinctly more material than normal. On the whole, in the urine collections of the patients, both with cancer and adrenal hyperplasia, the ratio of the fractions varied

[6] W. Pearlman, *Endocrinology*, 30: 275, 1942.

[7] N. H. Callow, *Biochem. Jour.*, 33: 559, 1939.

[8] N. H. Callow and R. K. Callow, *Biochem. Jour.*, 33: 931, 1939.

considerably from one individual to another and, as noted above, individual urine collections contained apparently specific and novel ketosteroids in Fractions II and IV. We are now endeavoring to accumulate quantities of these substances sufficient for chemical characterization.

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CONTROL OF FLOWERING WITH PHYTOHORMONES[1]

ATTEMPTS to influence flowering in *Ananas comosus* (L.) Merr. have involved experiments with certain synthetic phytohormones, including α-naphthaleneacetic acid, naphthaleneacetamide, naphthalenethioacetamide and a commercial product known as *Fruitone*. It has now been established that flowering can be induced in advance of the normal period or delayed until much later by the use of appropriate concentrations of these chemicals.

Typical data are given in Tables 1 and 2. Low concentrations of α-naphthaleneacetic acid (the compound used most extensively) applied as foliage sprays induced formation of inflorescences in advance of the normal period, but high concentrations, particularly when applied in solution at the apex, delayed flowering far beyond that of the controls. The fact that natural flowering of a uniform fall planting of slips occurs at a fairly definite season made it possible to schedule applications of the substances at desired intervals prior to normal differentiation of the inflorescence.

Flowering in *Ananas* involves a transition from the differentiation of vegetative structures to the formation of an inflorescence at the apical meristem. Steps in the process follow in succession, as already described.[2] The diameter of the meristem first widens, then flower bud primordia instead of leaf primordia are produced, and the peduncle elongates. The meristem gradually narrows again during the production of floral primordia and finally resumes differentiation of leaf primordia which give rise to the crown or top terminating the main axis of the plant.

An interval of about 2 months elapses from the time that the meristem first widens until the young inflorescence becomes externally visible in the center of the plant. From this fact it appears that the early stages in differentiation of the inflorescence must have followed shortly after the first application of the lowest concentration of naphthaleneacetic acid (Table 1). Conversely, differentiation of floral parts was greatly retarded by the highest concentrations (Table 2),

TABLE 1

EARLY FLOWERING INDUCED BY DILUTE SOLUTIONS OF α-NAPHTHALENEACETIC ACID SPRAYED ON LEAVES FOUR MONTHS PRIOR TO NORMAL DIFFERENTIATION OF INFLORESCENCE

Concentration of solution Per cent.	Weekly applications No.	Plants No.	Plants which had formed flower buds at stated periods after first application	
			2 months No.	3 months No.
Controls	–	20	0	0
.001	6	20	20	20
.006	1	20	18	20
.006	3	20	9	19

TABLE 2

DELAY OF FLOWERING BY MORE CONCENTRATED SOLUTIONS OF α-NAPHTHALENEACETIC ACID POURED IN CENTER OF PLANT ONE MONTH PRIOR TO NORMAL DIFFERENTIATION OF INFLORESCENCE

Concentration of solution Per cent.	Biweekly applications No.	Plants No.	Plants which had formed flower buds at stated periods after first applicaton		
			4 months No.	6 months No.	8 months No.
Controls ..	–	20	19	20	20
.01	3	20	0	16	19
.05	3	20	0	1	7
0.1	3	20	0	0	3
0.1	1	20	0	18	20

although new leaves were formed after the applications which resulted in the longest delay in flowering. When early flowering was induced by the low concentrations of these chemicals there was no external evidence of abnormal development of tissues. When flowering was delayed for a long period of time, however, considerable distortion and constriction was observed in the portion of the stem and in the leaves at the level of the apical meristem at the time of application of the phytohormones.

Since the differentiation of the inflorescence itself was initiated (Table 1) in our experiments, the results differ from earlier uses of the same or similar phytohormones in the production of parthenocarpic fruits,[3,4] the hastening of flowering by seed treatments which accelerated growth[5,6] or premature flowering of tobacco which was said to be due to

[1] Published with the approval of the Acting Director as Technical Paper No. 139 of the Pineapple Research Institute of Hawaii, University of Hawaii.

[2] K. R. Kerns, J. L. Collins and H. Kim, *New Phytol.*, 35: 305–17, 1936.

[3] F. G. Gustafson, *Proc. Nat. Acad. Sci.*, 22: 628–36, 1936.

[4] F. E. Gardner and P. C. Marth, SCIENCE, 86: 246–7, 1937.

[5] K. V. Thimann and R. H. Lane, *Am. Jour. Bot.*, 25: 535–43, 1938.

[6] H. L. Stier and H. G. duBuy, *Proc. Am. Soc. Hort. Sci.*, 36: 723–31, 1939.

hastening of the terminal growth after the flower buds were formed.[7]

The initiation of flowering by these substances does not necessarily imply that they are "florigens"[8] since they have other effects on plant growth. Furthermore, acetylene and ethylene, compounds chemically quite unrelated to these phytohormones, also induce premature flowering in *Ananas*.[9,10]

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

SELF-STERILIZING SURFACES

IT is known that extremely small quantities of ionized silver can have a remarkable germicidal effect;[1] it has also been found that one must distinguish between effects produced by small silver ion concentrations in water (volume effect) and those occurring when microorganisms are brought into wetting contact with surfaces upon which Ag is absorbed (surface effect). In the former case the destruction of the organisms is mostly a matter of hours and a variation of the Ag concentration up to 2 parts per million produces no remarkable change in the rate of sterilization. Furthermore, it is difficult, if not impossible, to attack spores of bacteria, molds and yeasts. This behavior is quite at variance with the very rapid destruction of cells which come into close contact with the extreme Ag concentrations existing on surfaces with absorptive capacity for Ag. Here the destruction of large numbers of organisms is reduced to minutes.

This phenomenon suggests a practical application in the form of self-sterilizing surfaces with lasting activity, if the incorporation of an adequate supply of atomic silver which replenishes the surface continuously after a wetting contact can be realized. As many organic colloids, in particular the proteins, bind and thus remove the silver from the surface after contact with it, a disactivation results unless a process of replacement can be provided for.[2]

The conditions for the permanency of the self-sterilizing qualities is thus the use of a material which (*a*) exposes at the surface only a small fraction of its total silver content, (*b*) holds this fraction in a form almost insoluble in water but available to proteins, (*c*) protects the unexposed supply against chemical attack, (*d*) permits replacement by diffusion.

Numerous organic liquids could fulfil these conditions, but most practical applications of such surfaces require rigidity. The only rigid substances with adequate properties are vitreous materials of anorganic (glasses) or organic (plastics) nature. The diffusion rate appears to be too small for the former (unless in colloidal form), and even of the plastics only certain types have so far been found to provide for sufficiently fast exchanges.

The compounding of silver with the resins can occur in various ways, either by the dissolution or the colloidal dispersion of silver compounds into the monomers or half-polymers of a resin or by their dissolution or dispersion in solvents of the plastic.

The additional incorporation of stabilizing as well as plasticizing substances is important, also intransparent neutral filling materials are required where a protection of the interior of the material against photochemical effects on the silver content is needed.

The resulting compounded substance represents then a varnish-like viscous fluid which can be applied by brush, spray or impregnation to various bases like plastics, glass, wood, paper, cloth, etc. It is hardened *in situ* either by polymerization or evaporation of the solvents. These surfaces are tasteless and odorless, resist mechanical wear and chemical attack by weak acids and alkali solutions as well as boiling water. They are, however, sensitive to certain organic solvents. The amount of silver removed from the surface by, *e.g.*, touch with the lips is of the order of micrograms, *i.e.*, negligible from the toxic angle. The total quantity of silver which the surface material must contain varies widely with the intended use of the surface and with its intended degree of permanency, it amounts to approximately one gram of silver for 1,000 cm² of exposed surface for the heaviest type of duty so far developed.

By the choice of the proper resin, its degree of polymerization, quantity and type of filling materials, etc., it is possible to vary the rate of Ag replacement, the absorptive capacity for water as well as the hygroscopic qualities of the surface. Hence surfaces which will be wet most of the time and come in frequent touch with large quantities of protein-like substances must have a high replacement rate

[7] A. E. Hitchcock and P. W. Zimmerman, *Contrib. Boyce Thompson Inst.*, 7: 447–476, 1935.

[8] M. Kh. Cajlachjan, *Compt. Rend. Acad. Sci., U. S. S. R.* (N.S.), 4: 79–83, 1936.

[1] Other metals, like gold and copper, share this property with silver at least to some extent. The reason for the particular focus on silver is due to its lack of toxicity compared with copper and its economic advantage over gold. It appears certain that similar materials can be developed with the incorporation of, *e.g.*, copper.

[2] The use of metallic silver surfaces may appear obvious because of the infinite supply of atomic silver. It is, however, easily demonstrated that metallic silver, even if very clean, is soon disactivated due to the formation of germicidally inert compounds.

[9] A. G. Rodriguez, *Jour. Dept. Agric. Porto Rico*, 16: 5–18, 1932.

[10] K. R. Kerns, "U. S. Patent No. 2,047,874," 1936.

but a low water permeability in order to prevent a premature exhaustion of the incorporated silver supply, while surfaces mostly dry require certain hygroscopic properties and an appreciable water permeability. Consequently the performance for which a particular surface material is designed represents by necessity a compromise between the rate of sterilization per unit area, the rate of replacement and the total "life time" required for the surface.

The method used for testing the germicidal activity of these surfaces was the following: Samples of the surface material (about 6 cm^2) on various bases were placed in humidified containers (for preventing bacterial destruction by drying). The test microorganisms suspended in the desired medium were pipetted onto the surface in volumes of 0.05–0.1 cc, spreading the liquid into a film. Analogously the controls were obtained on neutral surfaces. At definite time intervals this film or part of it was removed by a sterile cotton swab, and was immediately introduced into 9 cc of lactose-beef or thioglycollate broth. After incubation at 37° C. for 1 to 5 days the growth was determined. A similar technique was applied for the quantitative determination of cell reduction by titration: the entire film was absorbed by the swab, the latter then soaked for 30 minutes in nutrient broth with frequent shaking before 1 cc was serially diluted and plated in nutrient agar. Colony counts were made after three to five days.

The test microorganisms used so far have been *E. coli, Staph. aureus, B. proteus, B. subtilis Cl. pasteurianum, Penicillium, Rhizopus* and *Sacch. cerevisiae.*

Distilled tap and peptone water, nutrient broth, 5 per cent. sucrose and dextrose solutions, cider and milk have been used as suspending media.

The germicidal action obtainable with various surface materials according to extended tests with the above methods are briefly this:

The rate of sterilization varies with the composition of the surface, the highest rate measured sterilizes *E. coli* at 10^8 cells/cc in less than one minute. Materials requiring rates of more than 5 minutes for *E. coli* at at least 10^5 cells/cc were discarded. The bacterial concentration does not influence in general the rate of sterilization.

For a given surface this rate does not vary appreciably with different types of organisms (except for spores). Mold suspensions containing high concentrations of spores were readily sterilized in all suspending media except nutrient broth and milk. This was demonstrated by exposing heavy mold suspensions in cider and sugar-peptone solutions for 1 to 5 minutes to surfaces applied within standard bottle caps, before applying them to 12-ounce bottles containing sterile cider or broth. After sealing, the nutrient was kept in permanent contact with the cap. Subsequent incubation (30 to 60 days) did not produce growth in any bottle, while control bottles with untreated caps showed heavy growth. For bacterial spores (*B. subtilis,* 10 days old, washed and heated to 100° C. for 5 minutes) reduction up to 97 per cent. has been obtained after 15 to 30 minutes exposure.

In general the rate of disinfection depends upon the concentration of protein-like matter in the suspending medium. In this respect milk is most severe, and a surface which destroys *E. coli* in water in about 2 minutes requires 15 to 30 minutes for the sterilization of non-sporulating bacteria in milk.

Endurance tests for various surface materials were made on a special testing machine, which dipped each sample every fifth minute for about 30 seconds into H_2O. At arbitrary intervals the above test was performed and it was found that the activity remained practically unimpaired for up to 30,000 infections over a period of 2 months. The final failure coincided in general with the destruction of the plastic surface by mechanical wear.

Without such treatment good surfaces have not shown disactivation during storage.

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W. K. Kellogg Foundation. W. K. KELLOGG, etc. Illustrated. Pp. 217. The Lakeside Press.

SCIENCE NEWS

Science Service, Washington, D. C.

THE SUN'S TEMPERATURE

HITLER, in his last speech before launching his much-delayed spring drive, repeated his alibi about the chilliness of the winter in Russia. If the earth's weather were only directly dependent on the sun's heat, it would be possible to promise him even colder winters for the next four years. Data compiled by Smithsonian Institution observers in many parts of the world, and by Dr. Charles G. Abbot, secretary of the institution, together with L. B. Aldrich and W. H. Hoover, indicate that the sun will be at its lowest ebb, thermally speaking, in 1945. After that, our planetary system's central furnace will begin to warm up again.

Unfortunately, the relation between the sun's radiation and the earth's temperature is not so simple and direct as that. Cooling off of the sun might even result indirectly in warming up of certain parts of the earth, by reducing the amount of cloudiness and thereby letting the sun's rays, even though diminished, shine longer on the earth surface.

Confident prediction of long-range fluctuations in the heat radiated by the sun can be made because of the many thousands of accurate readings of solar heat, taken daily with specially designed, highly sensitive instruments, in observatories at Mt. Montezuma in Chile, Mt. Saint Katherine in the Sinai wilderness and Table Mountain in the Mojave Desert of California. These have been carefully tabulated and are published, with interpretations, in Volume 6 of the Annals of the Astrophysical Observatory of the Smithsonian Institution, just off the press.

Study of this mass of data shows that there are 14 distinguishable intensity cycles in the sun's radiation. Some of them are of only brief duration, others require years for the swing from high to low. Once every 23 years, all the lows come in together, and that combination low-point is due in 1945.

There seems to be little direct relation between solar radiation per se and the numbers of sunspots. Sunspots, however, do have their own effect on the earth's weather. They give off vast streams of electrically charged particles that shoot through space. Some of them, entering the earth's atmosphere, serve as nuclei for the condensation of water vapor in the upper atmosphere and thus lead to the increase of cloudiness and of rainfall, which may be entirely independent of heat effects.

LATEST COMET TO RETURN THIS YEAR

A COMET whose terrestrial history is more significant than its celestial record has returned to our evening skies, bringing with it an example of the results of international coordination. "Pure science knows no international barriers" is a statement made by modern scientists, but often its truth is belied by the serious facts of war.

But the heavens are still free hunting-grounds for all men, and friend and foe alike coordinate their efforts in tracking down its vagabonds, chief of which are the ever-mysterious comets. The latest wanderer into our embroiled part of the solar system is what astronomers prosaically call "periodic comet Grigg-Skjellerup."

According to Dr. Harlow Shapley, director of Harvard College Observatory, the new visitor might well be called the international salesman of the sky, for it represents first New Zealand, then Finland, then England, Belgium, the United States, Sweden, Denmark, and last, but not least, Japan. No two countries figure twice in its history, which begins with its discovery by the New Zealander, Grigg, in 1902.

The latest rediscovery of comet Grigg-Skjellerup has been made by a Japanese astronomer, S. Kanda, our information coming in the form of a cable from Lund, Sweden, where it had been received from Copenhagen, Denmark, which had received the news from Japan. (In the past year, Lund has replaced Copenhagen as a clearing house for European and Asiatic information.)

However, Kanda's observation was no news to American astronomers, as the Belgian-American, Dr. George Van Biesbroeck, at the Yerkes Observatory of the University of Chicago, had already seen the comet on April 11. Dr. Shapley stated that announcement of this failed to reach Lund, as cablegrams and radiograms can not go through, and Harvard's regular announcement cards, sent by mail, are apparently still in transit.

Finland enters this comet's history in 1922, when Skjellerup rediscovered it; after that it was seen in 1927 and at five-year intervals. Its return this year was therefore expected, and the position reported by Kanda is almost exactly at that place predicted by English astronomer Cripps (not Sir Stafford).

Amateur astronomers may want to look for comet Grigg-Skjellerup, which Kanda reported to be 10th magnitude on May 9. It is moving rapidly through the southeastern part of Gemini in a northeasterly direction. Its positions are:

May 17: right ascension 7 hours 37 minutes, declination 15 degrees 4 minutes north;

May 25: right ascension 8 hours 11 minutes, declination 19 degrees 32 minutes north;

June 2: right ascension 8 hours 53 minutes, declination 25 degrees 15 minutes north.

—CHARLES A. FEDERER, JR.

A NEW INSECTICIDE

A NEW insect-killing chemical, derived from Southern pine, promises to increase American independence of war-pinched imports. The substance, discovered by chemists of the Hercules Powder Company at Wilmington in the course of research on turpentine and pine oil, can be substituted for pyrethrum and rotenone in fly-killing sprays used in homes and dairy barns. It is stated to be effective against such domestic pests as mosquitoes, roaches, moths, ants, mites, silverfish, bedbugs, centipedes and spiders.

Pyrethrum, at present the principal ingredient of insect

sprays, was formerly practically a monopoly of Japan. Now it is produced on a large scale in the British African colony of Kenya, but lack of shipping has cut the supply. Rotenone, the other great fly-spray poison, comes from plants that grow in the East Indies and also in South America. But the Japs have the East Indies for the time being, and shipping lack again imposes restrictions on the South American supply. Promise of a large supply of home-made insecticide is therefore welcomed by spray manufacturers and users.

After trials on laboratory fly populations, the claim is made that the new material kills females as effectively as it does males. For some unknown reason, pyrethrum sprays have been chiefly effective against male flies. Obviously, a better kill of females is a great advantage.

The cost of the new insecticide is said to compare favorably with that of pyrethrum. Chemically, it is defined as the thiocyanoacetate of a secondary terpene alcohol. For convenience, it has been given the trade name Thanite.

Experimental work with the killing agent in fly sprays has been carried on by a cooperative fellowship at the University of Delaware under the direction of Dr. L. A. Stearns, and in livestock sprays by the Kansas State College of Agriculture under the joint direction of Dr. Roger C. Smith, of the Entomology Department, and Dr. F. W. Atkeson and Dr. A. O. Shaw, of the Dairy Husbandry Department.

SURGICAL OPERATION FOR DEAFNESS

DELICATE surgery which resulted in improved hearing for 88.9 per cent. of 117 patients who were hard of hearing is described by Dr. George E. Shambaugh, Jr., of Chicago, in the current issue of the *Journal* of the American Medical Association.

The patients' hearing had been damaged by an abnormal growth of sponge-like bone over the tiny "window" in the inner ear which normally admits the sound waves. Termed otosclerosis, this condition was found the cause of hearing loss in 70 per cent. of cases studied by Dr. Shambaugh in Washington.

Normally the sound waves are carried by the ear drum and the hammer, anvil and stirrup bones to the auditory nerve, and thence to the hearing centers of the brain. The sound is transmitted to the auditory nerve through a tiny oval window. In patients with advanced otosclerosis this little window is closed to sound, and the patient's hearing is impaired.

Dr. Shambaugh cuts a new window in the inner ear with a dental finishing burr. He uses a binocular dissecting microscope to help him see the very tiny inner ear structures while making the new window. During the operation, Dr. Shambaugh constantly irrigates the ear to wash away every particle of the bone dust while making the window to prevent the dust from falling into the window and leading to the formation of new bone which would close the new window. Such closing of the new-made window has been a cause of failures of the operation in the past.

Use of the microscope and the irrigation are Dr. Shambaugh's contribution to the so-called fenestration operation. He has successfully restored permanent hearing to most of his 117 patients by means of this operation over a period of more than three years.

Dr. Shambaugh considers restoration of hearing probably permanent if it remains after six months. If the operation is successful, the patient hears better than with a hearing aid.

However, Dr. Shambaugh states that the operation is not always successful and in some cases the hearing is made worse. Further, the operation is of no value if the auditory nerve does not function normally. His patients, therefore, are selected with care.

PSYCHIATRIC EXAMINATIONS OF NAVAL RECRUITS

How Navy psychiatrists are saving money and precious manpower for both the Navy and local communities by returning to suitable jobs in civilian life those men likely to break mentally under the unusually severe strains of sea warfare was disclosed by Commander Uno H. Helgesson before a joint meeting of the American Psychiatric Association and the American Psychopathological Association. Very prompt psychiatric first aid treatment for battle casualties was also urged. He suggested mobile first-aid posts which could be sent right to the scene of battle.

The Navy is not the cold, impersonal machine that military organizations are commonly thought to be, Commander Helgesson said. Consideration has been given to the effects on the individual and community morale of sending a man home after he has been sworn in.

So the Red Cross was requested to furnish psychiatric social workers who act as liaison between the Navy and the community and family. Through local Red Cross chapters, psychiatric social workers at the Navy training stations have been able to get the rejected men into their old jobs or into new ones better suited to them, or they have put them into the hands of competent clinics or welfare organizations for such assistance as they need. It is explained to the rejected man that as a civilian worker he has a function as important in this war as that of a sailor.

Those rejected include the "weak sisters," the "gripes" and those who resent authority and the "sick bay addicts" who can rarely be counted on in an emergency, as well as men with epilepsy or the early symptoms of actual mental disease. If such men were not removed from duty early in their service, it would deprive war industries of workers and at the same time be a great loss to the Navy.

"The economic loss from this kind of casualty, although it probably would run into the millions in a year's time, is not so serious as the loss in manpower and efficiency," Commander Helgesson said.

"We have no unlimited supply of commissioned officers and petty officers to train our new recruits. All the money in the world can not buy a ready-made experienced commissioned officer or petty officer. Economy of manpower is, therefore, particularly essential among officer and petty officer personnel."

Mobile psychiatric first aid posts were urged by Com-

mander Helgesson to care for psychiatric battle casualties. These acute mental conditions following combat are of quite a different nature from peace-time neuroses. They are mental breakdowns in the face of difficulties which are not the common experience of man. It is a well-known fact that the majority of these combat casualties can be returned to useful civilian occupations if treated early enough. The trouble is that naval casualties occur in widely scattered areas and a long time, sometimes weeks, may elapse before they reach a naval hospital.

Among British casualties and also American, there are some who go into a deep stupor like that in some cases of the mental disease schizophrenia. But in the case of the battle casualties, it has been found that prompt treatment results in quick and relatively complete improvement. This peculiar form of psychiatric battle casualty seems to be more common in this war than in any before.

FLUORINE AND TOOTH DECAY

HOPE of preventing tooth decay by swabbing a chemical solution on the teeth appears in a report by Dr. Virgil D. Cheyne, of the School of Dentistry of Indiana University, in the *Journal* of the American Dental Association.

The solution is potassium fluoride. Drinking water that contains fluorides causes the ugly condition of mottled enamel, but even a small amount of fluorides in the water, it has been discovered, prevents tooth decay. However, this effect, it was formerly believed, depended on the fluorides getting into the teeth *via* the drinking water at a very early age, while the teeth are being formed in the jaws. Recent experiments by others suggested that the fluorides might get into the teeth enamel after the teeth had erupted. Dr. Cheyne swabbed a potassium fluoride solution every three months or so on the "baby" teeth of 27 four- to six-year-old children from the underprivileged sections of Indianapolis. All the children had decayed teeth at the start of the experiment. One year later these children and nineteen others with the same economic and dental status were reexamined. These nineteen untreated children had developed almost twice as much new tooth decay as the 27 treated children. Further tests on more children over a longer period of time will be needed for final evaluation of the method, but the results so far point to a new method of attacking the widespread problem of tooth decay.

ITEMS

NEW earthquake shocks felt in Guayaquil, Ecuador, on Friday, May 15, were not centered at the same point as the ones that caused death and wreckage in the city on the previous day, according to the report of seismologists of the U. S. Coast and Geodetic Survey after examining wired data transmitted from three American observatories. At least one of the disturbances originated under the sea bottom about 100 miles off the coast, in latitude 1.5 degrees north, longitude 81.5 degrees west. It was a fairly strong shock, beginning at 4.38.6 A.M., E.W.T.

THAT realistic background of beautiful scenery or exotic landscape that you see in a movie may be merely another movie. Instead of going on location for all outdoor scenes, the new technique of projecting allows producing companies to work indoors with all the comforts and advantages of studio life and the results of shooting in the great outdoors. R. W. Henderson, of Paramount Pictures, told the Society of Motion Picture Engineers meeting in Hollywood that this relatively new method of photographing for background purposes other motion pictures projected on a translucent screen allows the making of some scenes that would be impossible by any other means. The projection background method is also resorted to when unforeseen difficulties delay production schedules.

THAT ready-made spare parts for repairing defects in human skulls are now available, is reported by Dr. Claude S. Beck, of the School of Medicine of Western Reserve University, in the *Journal* of the American Medical Association. They are metal plates made of the alloy, vitallium, which have been found most satisfactory for repair of skull and other bone defects. Heretofore plates used to repair skull defects, for example, to replace a piece of skull removed in case of tumor, have been specially cast from a pattern of the defect. Dr. Beck had "the idea of using plates made up in various sizes and kept in stock so that the surgeon could use them when needed." The plates might be useful in the care of war wounds, he points out. If the wound is not infected, the plates might be put in at the first operation. Almost any defect can be repaired by plates whose measurements are 6, 10 and 14 centimeters in length and 2 or 3 centimeters in width.

THE U. S. Public Health Service has published a report of what it believes is the first discovery of a live mouse on a passenger plane in quarantine. The animal was found in the galley of an airliner from San Juan, Puerto Rico, after the plane landed at the quarantine station in Miami, Fla. The Federal health service points out that mice have been found to carry the germ of lymphocytic chorio-meningitis, a dangerous but little known disease which attacks humans. More important, they state, is the possibility of plague-infected rats boarding planes unknown to passengers or crew, and contaminating food.

ONE million pounds of dehydrated apples are being bought by the Army for apple sauce, apple pie and eating with cereal. One part (by weight) of the dehydrated apple "nuggets" equals seven parts of sauce or pie filling, and is superior in flavor to the dried fruit, Army food experts say. So far the apple is the only dehydrated fruit, except the lemon, being purchased for U. S. troops, because for most fruits now bought on a quantity basis the dried form is satisfactory. The dehydrated fruit is said to have a "delicious, tart flavor."

ORGANIC changes, rather than psychological, may explain the results obtained from electric shock therapy, in the opinion of Dr. Bernard Glueck, Jr., of Stony Lodge, Ossining, N. Y., reported at the Boston meeting of the American Psychopathological Association. In five patients suffering from manic-depressive and involutional psychoses, the organic disturbances of the brain cortex and other physical results from electro-shock therapy may explain their prompt response to this treatment.